FORM PTO-1390 (Modified) (REV 10-95) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	
SIM0065	
U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	09/367670

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/CA98/01146	18 December 1998	18 December 1997

TITLE OF INVENTION

INTELLIGENT COMMUNICATION SERVER AND COMMUNICATION SYSTEM INCORPORATING SAME

APPLICANT(S) FOR DO/EO/US

COVELEY, Michael and MILUTINOVIC, Srdjan

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
    A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☒ Other items or information:

Notice Informing The Applicant Of The Communication Of the International Application To The Designated Offices (PCT/IB/308) and Check # 042755

514 Rec'd PCT/PTO 18 AUG 1999

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/36,7670	PCT/CA98/01146	SIM0065

20. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☐ Search Report has been prepared by the EPO or JPO **$840.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) **$670.00**
- ☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **$760.00**
- ☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO **$970.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) **$96.00**

	CALCULATIONS PTO USE ONLY	
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$970.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	19 - 20 =	0	x $18.00	**$0.00**	
Independent claims	3 - 3 =	0	x $78.00	**$0.00**	
Multiple Dependent Claims **(check if applicable)**.			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$970.00**	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable).**			☐	**$0.00**	
SUBTOTAL =				**$970.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$970.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☒	**$80.00**	
TOTAL FEES ENCLOSED =				**$1,050.00**	
				Amount to be: refunded	$
				charged	$

☒ A check in the amount of **$1,050.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-0385** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

John F. Hoffman
BAKER & DANIELS
111 East Wayne Street, Suite 800
Fort Wayne, IN 46802

TX: (219) 424-8000
FAX: (219) 460-1700

SIGNATURE

JOHN F. HOFFMAN
NAME

26,280
REGISTRATION NUMBER

August 13, 1999
DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of	)	
Michael Coveley et al.	)	Group Art Unit:
Serial No.	)	
Filed:	)	
Title: INTELLIGENT COMMUNICATION	)	Examiner:
SERVER AND COMMUNICATION	)	
SYSTEM INCORPORATING SAME	)	

PRELIMINARY AMENDMENT DELETING MULTIPLE DEPENDENT CLAIMS

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

Prior to calculating the filing fee, please enter the following amendments to the application.

IN THE CLAIMS

In claim 4, line 1, delete "in any of the preceding claims" and substitute therefor --claim1--.

In claim 9, line 1, delete "any one of claims 4 to 8" and substitute therefor --claim 4--.

In claim 19, line 1, delete "any one of claims 16 to 18" and substitute therefor --claim 16--.

Respectfully submitted,

John F. Hoffman
Registration No.26,280

Attorney for Applicant

JFH:pmp/93194.1

BAKER & DANIELS
111 East Wayne Street, Suite 800
Fort Wayne, IN 46802

Date: August 18, 1999

Applicant or Patentee: Michael E Coveley et al
Attorney's Docket No : _____
Serial or Patent No.: N/A
Filed or Issued: Herewith
For: Intelligent Communication Server and Communication System Incorporating Same

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(b))
INDEPENDENT INVENTOR

As an assignee, I hereby declare that I qualify as an independent inventor as defined in 37CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled INTELLIGENT COMMUNICATION SERVER AND COMMUNICATION SYSTEM INCORPORATING SAME described in

[X] the specification filed herewith
[ ] application serial no. _____, filed _____
[ ] patent no. _____, issued _____

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37CFR 1.9(d) or a nonprofit organization under 37CFR 1.9(e)

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contractor law to assign, grant, convey, or license any rights in the invention is listed below:

[xx] no such person, concern, or organization
[ ] persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1 27)

FULL NAME _____
ADDRESS _____
[ ] Individual [ ] Small Business Concern [ ] Non-Profit Organization

FULL NAME _____
ADDRESS _____
[ ] Individual [ ] Small Business Concern [ ] Non-Profit Organization

FULL NAME _____
ADDRESS _____
[ ] Individual [ ] Small Business Concern [ ] Non-Profit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false

SC Aug. 19/1999

statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Solbyung Coveley

ADDRESS OF PERSON SIGNING 6 Fairview Avenue, Richmond Hill, Ontario, L4C 6L2, Canada

SIGNATURE [signature] DATE Aug. 17, 1999

Applicant or Patentee Michael E. Coveley et al
Attorney's Docket No:
Serial or Patent No.: N/A
Filed or Issued: Herewith
For: Intelligent Communication Server and Communication System Incorporating Same

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c))
SMALL BUSINESS CONCERN

I hereby declare that I am

[ ] the owner of the small business concern identified below
[X] an official of the small business concern empowered to act on behalf of the concern identified below

NAME OF CONCERN: cStar Technologies Inc
ADDRESS OF CONCERN: 1-1122 Finch Avenue West, Toronto, Ontario M3J 3J5 Canada

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled INTELLIGENT COMMUNICATION SERVER AND COMMUNICATION SYSTEM INCORPORATING SAME by inventors Michael E. Coveley and Srdjan Milutinovic described in

[xx] the specification filed herewith
[ ] application serial no. _____, filed _____
[ ] patent no _____, issued _____

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). (*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27).)

NAME _____
ADDRESS _____
[ ] Individual [ ] Small Business Concern [ ] Non-Profit Organization

NAME _____
ADDRESS _____
[ ] Individual [ ] Small Business Concern [ ] Non-Profit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

SC Aug. 19, 1999

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Solbyung Coveley
TITLE OF PERSON OTHER THAN OWNER President & CEO
ADDRESS OF PERSON SIGNING 6 Fairview Avenue, Richmond Hill, Ontario, L4C 6L2, Canada

SIGNATURE [signature] DATE Aug. 17, 1999

INTELLIGENT COMMUNICATION SERVER AND COMMUNICATION SYSTEM INCORPORATING SAME

TECHNICAL FIELD

The present invention relates to communication systems and in particular to an intelligent communication server to enhance communications connectivity in wireless and/or land-line networks and to a communication system incorporating the same.

BACKGROUND ART

In today's communications environment, users on different networks must communicate with each other. This makes internetworking among various telecommunications networks an important and challenging technological task. The majority of current interconnected telecommunication networks provide support only for selected applications. It is of course desired that interconnected telecommunication networks support virtually all applications. Difficulties in communications connectivity between applications on wireless networks and host computers on land-line wired networks has been of concern. Also, the growth of existing services and the introduction of new services on communication networks has significantly increased traffic flow. In heterogeneous wired and wireless networks, communication servers must be able to cope with capacity and network failures while being cost efficient. Accordingly, communication servers which provide flexible communications connectivity between participants are desired.

It is therefore an object of the present invention to provide a novel communication server to enhance communications connectivity in wireless and/or land-line networks and to provide a novel communication system incorporating the same.

DISCLOSURE OF THE INVENTION

According to one aspect of the present invention there is provided a communication system comprising:

at least two communication networks over which communications between physical devices connected to said communication networks are to be carried, said communication networks implementing different protocols for messaging; and

a communication server acting between said communication networks and through which messages transmitted between said communication networks pass, said communication server including a knowledge base storing protocol conversion information, said communication server accessing said protocol conversion information in said knowledge base upon receipt of a message and converting the protocol thereof to a protocol compatible with the communication network to which said message is being sent.

Preferably, the communication server includes virtual devices communicating with the communication networks and a virtual gateway bridging the virtual networks. The virtual gateway accesses the knowledge base and converts protocols of the messages. Preferably, the virtual gateway includes a preprocessor, a processor and a postprocessor. The preprocessor examines each incoming message to locate target logical connection information determining the target destination for the incoming message. The processor converts the protocol of each incoming message, where appropriate, based on the target logical connection information. The postprocessor wraps each message received from the processor with headers, where appropriate.

In a preferred embodiment, one of the communication networks is a wireless network and another of the communication networks is a wired land-line network. Messages transmitted over the wireless network include API messages to be processed by destination physical devices and target logical connection information specifying the destinations for the API messages. The target logical connection information is included in a logical message header wrapping the API messages. Preferably, the preprocessor in the virtual gateway strips the logical message header from the API message upon receipt of a message from a wireless network and uses the logical message header as a key to search the knowledge base for the protocol conversion information. If the preprocessor is unable to obtain the target logical connection information from the logical message header, the preprocessor analyzes the API message of the message received from the wireless network for the target logical connection information.

According to another aspect of the present invention there is provided a communication server to act as a gateway for the transmission of messages between

two virtual devices communicating with networks implementing different protocols, said communication server comprising:

a knowledge base storing protocol conversion information to convert messages of one protocol to a different protocol; and

a virtual gateway accessing said protocol conversion information upon receipt of a message to be transmitted between said virtual devices and converting the protocol of said message to a protocol compatible with the network to which said message is being sent.

In still yet another aspect of the present invention there is provided a A communication system comprising:

a wireless network;

at least one wireless terminal to transmit messages over said wireless network;

a land-line network;

at least one host computer connected to said land-line network to transmit messages over said land-line network; and

a communication server providing communications connectivity for messages to be transmitted from one network to the other, wherein said at least one wireless terminal and said communication server include registries, said registries including mapping information to map physically said at least one wireless terminal to said land-line network to enable messages transmitted by said at least one wireless terminal to be delivered to said at least one host computer.

The present invention provides advantages in that communications connectivity between physical devices on a wireless network and physical devices on a land-line network is maintained even though the API data of physical devices may not provide for direct communications connectivity. In addition, the present invention provides advantages in that the communication server includes a knowledge base to deal with "special" communication protocol conditions as they arise.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the present will now be described more fully with reference to the accompanying drawings in which:

Figure 1 is a schematic block diagram of a communication systems including a communication server in accordance with the present invention;

Figure 2 illustrates the network infrastructure of the communication system of Figure 1;

Figure 3 illustrates message structure in the communication system of Figure 1;

Figure 4 illustrates a communication system including a communication server acting between wireless terminals on a wireless packet data network and host computers on land-line wired networks in accordance with the present invention;

Figure 5 is a schematic block diagram of one of the wireless terminals in the communication system of Figure 4;

Figure 6 shows outgoing message flow in the wireless terminal of Figure 5;

Figure 7 shows incoming message flow in the wireless terminal of Figure 5;

Figure 8 is a schematic block diagram of the communication server in the communication system of Figure 4;

Figure 9 is another schematic block diagram of the communication server in the communication system of Figure 4;

Figure 10 is a schematic block diagram of a virtual gateway forming part of the communication server of Figures 8 and 9;

Figures 11 to 13 are block diagrams showing message processing in the virtual gateway of Figure 10;

Figure 14 shows communications connectivity between wireless terminals and host computers in the communication system of Figure 4; and

Figure 15 shows an OSI model protocol stack and its conversions in the communications path across the communication system of Figure 4.

BEST MODE FOR CARRYING OUT THE INVENTION

In the well known OSI Reference Model, every device that connects two computer systems or networks, that are not connected to each other, is referred to

as a relay. In accordance with this terminology, a bridge functions as a data link layer relay. A router represents a network layer relay, and a gateway is any relay at a layer that is higher than the network layer. Nonhomogenity and a broad variety of differences between interconnected networks needs to be resolved by numerous functions performed by these relays in order to achieve connectivity. Some of those tasks to be resolved are: a) routing techniques; b) error control; c) flow control; d) user access control; e) close procedures; f) communication monitoring and traffic handling; g) statistics; and h) network efficiency to name but a few. The present invention relates to a communication server, which provides communications connectivity between wireless and/or land-line networks.

Turning now to Figures 1 and 2, a communication system in accordance with the present invention is shown and is generally indicated to by reference numeral 10. As can be seen, communication system 10 includes a communication server 12 communicating with physical devices 14. The physical devices 14 include wireless terminals 16 such as point-of sale terminals or the like as well as host computers 18. The wireless terminals 16 communicate with the communication server 12 over a wireless packet data network (WPDN) 20. In this particular example, the WPDN is a DataTAC (ARDIS) based network. The host computers 18 communicate with the communication server 12 over land-line based networks 22 such as for example, X.25 and TCP/IP protocol based networks.

During communications between communicating physical devices 14 in the communication system 10, application (API) messages AMSGs are exchanged between the physical devices for processing. On the wireless network side, the API messages AMSGs are transmitted as logical messages LMSGs. The logical messages include the API messages to be processed as well as destination information for the API messages. In this manner, the communication server 12 can determine the desired destination of the API messages as well as their required form when passed to the desired destination. Specifically, API messages AMSGs transmitted over the WPDN 20 are wrapped with virtual device message headers VDMSG_HDRs and with logical message headers VMSG_HDRs. API messages AMSGs transmitted over the land-line network 22 are not wrapped. Although not shown, API messages AMSGs may also be wrapped only by virtual device message headers VDMSG_HDRs. Figure

3 shows wrapped API message AMSGs. The communication server 12, which receives all API messages transmitted between physical devices 14, unwraps and wraps API messages and performs API message protocol conversion, when required, thereby to provide communications connectivity between the physical devices 14.

The wireless terminals 16 follow a logical model consistent with the communication server 12. The host computers 18 on the other hand do not follow the logical model followed by the wireless terminals 16 and communication server 12. Thus, communications through the communication server 12, between a wireless terminal 16 and a host computer 18, are based on communications between a "known application" and an "unknown host" "Unknown" in the context of the present application refers to the fact that the communication server 12 only knows the basic API levels of the host computers 18. Since the host computers 18 are typically managed by third party institutions, there is little that can be done to change their API levels to allow them to communicate directly with the wireless terminals 16. Therefore, this poses a potential communications problem especially when a message is transmitted from a host computer 18 that is to be delivered to a wireless terminal 16.

According to Tanenbaum, every communication entity within a communications environment has to be identified in order to establish communications with other entities. Three terms that are applicable to this concept are names, addresses, and routes. The important step in this concept is the logical address which leads to the concept of an API logical message generated on an API level.

In the present communications system 10, the above-identified potential communications problem between host computers 18 and wireless terminals 16 is overcome by the communication server 22 which wraps and unwraps API messages as required to establish two way logical communications between the host computers 18 and wireless terminals 16

To achieve communications in the communication system 10, physical devices 14 taking part in the communications require unique logical addresses. Each logical address comprises three identification levels (IDs), namely a system ID, an application ID and a component ID. The general format for the logical address is:

System ID. Application ID. Component ID.

The system IDs identify systems within the logical model. The length of the system ID (i.e. its number of bytes) depends on inputs and designates many of the systems. The application IDs identify the logical units within the communication system 10, including the wireless terminals 16, the communication server 12 and the host computers 18. Basically all participants in the communication system 10 are assigned an application ID. This is an abstract definition, which does not care about physical connections. The component IDs identify all components within the logical units such as drivers, communication managers, bank credit components, bank debit components, etc.

The logical model enables logical connectivity among everything participating in communications over the communication system 10. It is important to note that this connectivity is not physical connectivity. This is API logical connectivity established in order to enable API messages to flow freely over the communication system.

Turning now to Figure 4, a specific implementation of the communication system in accordance with the present invention is shown and is generally indicated to by reference numeral 110. As can be seen, the communication system 110 includes a communication server 112 incorporating a server 124 and a backup server 126 interconnected via an Ethernet backbone 128. Workstations 130 are also connected to the communication server 112 by way of an Ethernet based network 132.

The communication server 112 is connected to a land-line based wired network 122 on one side and to a wireless packet data network (WPDN) 120 including a plurality of WPDN base stations 162 on the other side. The land-line based network 122 includes a plurality of physical devices 14 such as host computers 140, 142, and 144 respectively, connected to the communication server 112 by way of an X.25 land-line packet data network 146. The land-line based network 122 also includes additional host computers 150 (only one of which is shown) connected to the communication server 112 by way of a TCP/IP protocol network 152.

The WPDN 120 includes a WPDN switch 160 acting between the communication server 112 and the WPDN base stations 162. Physical devices 14 in

the form of wireless terminals 164 communicate with the WPDN base stations 162 by way of wireless RF communications links 166.

Wireless terminals 164 communicate with the host computers 140 to 144 and 150 through the communication server 112 over the WPDN 120 and land-line network 122. Likewise the host computers communicate with the wireless terminals 164 over the same communication network. Wireless terminals 164 also communicate with other wireless terminals 164 via the communication server 112 over the WPDN 120. The host computers also communicate with each other via the communication server 112 over the land-line based network 122.

Further specifics of the communication system 110 and is operation will now be described.

Wireless Terminals

Referring now to Figures 5 to 7, one of the wireless terminals 164 is schematically illustrated. As can be seen, the wireless terminal 164 includes a message dispatcher 200 connected to a communication manager 202 and to the various components 204 of the wireless terminal 164 via a software bus 207. The message dispatcher 200 and communication manager 202 manage message flow in the wireless terminal 164. Specifically, the message dispatcher 200 manages the registration and unregistration of components in the wireless terminal while the communication manager 202 handles incoming and outgoing logical messages.

The message dispatcher 200 includes a check registry 211 communicating with a message office 206 including an internal registry 208 and mailboxes 210. The communication manager 202 includes a check registry 220 communicating with a knowledge base 212 providing physical mapping to message destinations. The communication manager 202 includes an autobridge and autorouter 214, virtual ports 216, input/output device drivers 218 such as an RF modem, SPI bus, RS 232, etc.

The knowledge base 212 physically maps the virtual ports 216 and device drivers 218 of the wireless terminal 164 to logical destination addresses such as the ports on the communication server 112 that communicate with the X.25 packet data network 146, TCP/IP protocol network 152, Ethernet network 132 and the

WPDN 120. The knowledge base 212 requires administration and can be constructed or updated in different ways and by different sources. For example, the knowledge database 212 can be constructed or updated (i) locally by an application manager; (ii) remotely by an administrator; or (iii) on the "fly" (run-time) as a learning process.

Figures 4 and 5 show internal outgoing and incoming message flow within a wireless terminal 164. When a component 204 of the wireless terminal 164 requires an outgoing API message to be sent, the API of the component 204 sends a request to the message dispatcher 200. The request is in the form of a SendPostMessage call and includes the component's handler, the message destination, the type of service requested and the message envelope or object. Upon receipt of the message request, the message dispatcher 200 sends the API message to the check registry 211. The check registry 211 in turn examines the internal registry 208 of the message office 106 to determine if a destination mailbox 210 for the API message exists. If a destination mailbox 210 for the API message is found by the check registry 211, the API message is internal. At this stage, a store service 209 stores the API message in the destination mailbox 210. The destination mailbox 210 in turn generates an event, which notifies the destination component of the wireless terminal 164 that a new API message is waiting. The message dispatcher 200 then sends a status return to the message sending component 204. When the destination component receives the event, the API of that component retrieves the event via a GetMessage call and processes the API message.

If a destination mailbox 210 does not exist, the API message is external. At this point, the message dispatcher 200 conveys the API message to the communication manager 202. Upon receiving the API message, the check registry 220 within the communication manager 202 checks the external registry 212 to get connectivity information for the API message based on the message destination. If no entry is found in the external registry 220 for the API message, the API message is discarded and an error message is returned to the message dispatcher 200 which in turn notifies the message sending component 204.

If connectivity information for the API message exists in the external registry 212, the API message and its connectivity information are passed to the autorouter 214 for processing. In response, the autorouter 214 returns a status

message to the message sending component 204 via the message dispatcher 200 and creates a logical message LMSG, which is passed to the appropriate device driver 218 based on the connectivity information. The device driver 218 sends the logical message LMSG to the physical output port allowing the logical message to be sent over the WPDN 120.

When an incoming logical message is received on an output port of the wireless terminal 164, the associated device driver 218 passes the incoming logical message LMSG to the check registry 220. The check registry 220 performs filtering and checking of the logical message based on information in the external registry 212 associated with the message sending party. If the logical message is not recognized, it is discarded by the check registry 220. During the checking and filtering of a recognized logical message LMSG, the check registry determines whether the message is to be processed by the autobridge 214 or conveyed as an API message to the message dispatcher 200. If the message is to be processed by the autobridge 214, the check registry 220 conveys the logical message to the autobridge which in turn routes the message to the proper device driver 218. Otherwise, the check registry 220 passes the API message to the message dispatcher 200.

When the message dispatcher 200 receives the API message from the communication manager 202, the check registry 211 checks the internal registry 208 to find the correct mailbox 210 for the received API message. When the mailbox is found, the API message is passed to the store service 209, which stores the API message in the mailbox 210. The mailbox 210 in turn generates an event to notify the component 204 associated with the mailbox that a new API message has arrived. When the component 204 receives the event from the mailbox 210, the API of the component 204 retrieves the API message via a GetMessage call. The API message is then processed by the API.

Communication Server

Referring now to Figures 8 and 9, the communication server 112 is better illustrated. As can be seen, the communication server 112 includes a front end in the form of a virtual host 280 communicating with the WPDN 120 and a back end in the form of a virtual terminal 282 communicating with the land-line based network

122. A virtual gateway 284 acts between the virtual terminal 282 and the virtual host 280. The virtual gateway 284 accesses a knowledge base 286 including a real time database. Rather than using hard-coding translation in the virtual gateway 284 to deal with different protocols used by the WPDN 120 and the land-line networks 122, the information required to translate protocols is recorded in the real time database of the knowledge base 286.

Turning now to Figure 10, the virtual gateway 284 is better illustrated. Virtual gateway 284 includes a preprocessor 300 receiving input from a virtual device VD (either the virtual host 280 or the virtual terminal 282) that receives logical messages from a sending physical device 14. The preprocessor 300 communicates with the knowledge base 286 and with a processor 302. Processor 302 also communicates with the knowledge base 286 as well as with a postprocessor 304. The postprocessor 304 communicates with the knowledge base 286 and provides output to a virtual device VD (either the virtual host 280 or the virtual terminal 282). The virtual device VD in turn sends a logical message to a receiving physical device 14 (either the virtual host 280 or the virtual terminal 282). An expert system tool kit 306 allows the knowledge base 286 to grow to meet the needs of the communication system 110.

The knowledge base 286, excluding the real time database, is divided into three parts, namely a registry, a static logical table and a dynamic database. The registry records basic information for each registered physical device 14 in the communication system 110. Each record in the registry includes a physical device ID, an application ID, a virtual device ID and a device properties ID. This information is entered into the knowledge base when the physical devices are registered. The registry also contains mappings from physical IDs to logical IDs. Each mapping represents one application of the registered physical device. Therefore, if the physical device uses two applications through the virtual gateway 284, two mappings associated with the physical device exist in the registry.

The static logic table stores logical information with respect to registered connections including logical connection IDs, logical device IDs, virtual device IDs, API IDs, logical message wrapping information, logical message unwrapping information, virtual device message wrapping information, virtual device

message unwrapping information, knowledge base IDs, virtual processor IDs and processor property IDs.

The dynamic database contains dynamic information. It is a real time database that updates the current status of each connection between physical devices in the communication system 112. Entries in the dynamic database include knowledge base IDs, logical connection IDs, connection status and current state.

The preprocessor 300 receives virtual device messages VDMSGs from either the virtual terminal 282 or virtual host 280 in response to logical messages LMSGs received by a virtual device VD from a physical device 14 such as a wireless terminal or a host computer. Messages received by the preprocessor 300 are conveyed to the processor 302. Following processing at the processor 302, the processed messages are conveyed to the postprocessor 304 which in turn passes the processed messages to either the virtual host 280 or virtual terminal 282. The virtual host 280 or virtual terminal 282 in turn passes the processed messages to the appropriate physical device 14.

The preprocessor 300 is designed to unwrap incoming messages and determine target logical connections for the incoming messages using a number of service processors as shown in Figure 11. When the preprocessor 300 receives a message from a virtual device VD together with its virtual device ID, the preprocessor 300 separates the incoming virtual device message VDMSG into a virtual device message header VDMSG_HDR and a logical message LDMSG (block 320). The logical message LDMSG is then further separated into a logical message header LDMSG_HDR and an API message AMSG (block 322). After the incoming message has been unwrapped, the preprocessor 300 determines the target logical connection ID for the API message. Specifically, the preprocessor 300 first attempts to retrieve the target logical connection ID from the knowledge base 286 using the virtual device message header VDMSG_HDR as a key (block 324). If the virtual device message header is absent or if retrieval of the target logical connection ID from the knowledge base 286 is not successful, then the preprocessor 300 attempts to retrieve the target logical connection ID from the knowledge base 286 using the logical message header LMSG_HDR as a key (block 326). If the logical message header is absent or if retrieval of the target logical connection ID from the knowledge base 286 is not

successful, the preprocessor 300 uses the API message AMSG as a key to search the knowledge base 286 for the target logical connection ID (block 328). Once the target logical connection ID is located, it is passed to the processor 302 with the API message.

When the processor 302 receives the API message and the target logical connection ID from the preprocessor 300, the processor 302 processes the API message. During processing, one of the business processors accesses appropriate protocol translation information in the knowledge base 286 based on the target logical connection ID. Once the translation information is accessed, another business processor handles the protocol translation using the accessed information (see block 330 in Figure 12). This of course makes gateway connections between the communicating virtual devices VD through the virtual gateway 284 more efficient and flexible since any changes in protocols can be reflected by updating the knowledge base 286. Also, by keeping translation information for various protocols in the knowledge base 286, the virtual gateway 284 can be used to connect virtually any communicating physical devices. After processing, the processed API message is passed to the postprocessor 304 together with the target logical connection ID.

When the postprocessor 304 receives the processed API message and the target logical connection ID from the processor 302, the postprocessor 304 retrieves logic message wrapping and virtual device wrapping from the knowledge base 286 based on the target logical connection ID and wraps the processed API message accordingly (see blocks 332 and 334 in Figure 13) thereby to form a virtual device message VDMSG. The destination virtual device is also retrieved from the knowledge base 286 using the target logical connection ID as a key and the virtual device message VDMSG is conveyed to the appropriate destination virtual device.

Since the wireless terminals 164 in this embodiment follow the same logical model as the communications server 112 and since logical messages transmitted by the wireless terminals include the target logical connection ID, logical messages LMSGs received by the communication server 112 from wireless terminals can be processed easily and routed to the proper destination.

API messages destined for wireless terminals that come from "unknown" sources such as host computers, which do not include a logical message

header LMSG_HDR, must be built into logical messages by the communication server 112. The business processors in the processor 302 use fuzzy logic and artificial intelligence to access the appropriate protocol information and build the logical messages. The tool kit 306 is used to initially build the knowledge base 286 so that it includes the basic API requirements of the host computers. As communications traffic passes through the communication server 112, the communication server 112 updates the knowledge base 286.

One special case that arises in communications between host computers and the communication server 112, is protocols with "zero messages". Protocols of this nature do not include API data. This of course prevents logical messages from being built. This is dealt with by the communication server 112 using the knowledge base 286.

As will be appreciated, since the knowledge base 286 stores connectivity information for the registered physical devices as well as protocol translation information and since logical messages transmitted by the wireless terminals 164 provide destination information, the communication server 112 is able to ensure communications connectivity between all physical devices in the communication system 112 regardless of network platforms.

In the present embodiment, the wireless network 120 is described as a DataTAC WPDN. DataTAC wireless packet switching data networks require 56 to 64 kbps backbone communication pipe per physical connection with SCR (standard context routing) over X.25, through PVCs (permanent virtual circuits) or SVCs (switched virtual circuits). The communication server 112 provides full connectivity to host computers via this communication path. Full connectivity is especially important in the case where the wireless terminals 164 transmit financial transaction data where ETE POS (end to end point of sale) protocol is a must. Unlike the communication server 112, DataTAC engine servers do not provide ETE connectivity.

The communication server 112 also supports other wireless networks such as for example Mobitex, CDPD, GSM or PCS. Mobitex wireless packet switching data networks are very similar to DataTAC WPDNs and therefore, the communication server 112 bridges the connectivity gap between this wireless network and land-line networks. CDPD wireless packet data networks are the most demanding

in terms of throughput and speed. These networks are entirely based on the TCP/IP protocols. GSM/PCS networks are circuit switched wireless cellular networks where again end to end (ETE) connectivity is an issue.

Connectivity

In addition to logical addressing, data exchange between a physical device 14 and the communication server 112 is another important part of the logical message. Data can be exchanged in two manners, namely asynchronously or synchronously. The logical message LMSG indicates which communication manner is supported and embeds this information into its header as a Type and Tag.

Asynchronous data exchange is datagram oriented. During asynchronous data exchange, a request datagram is sent to the communication server 112 by the physical device. The communication server 112 responds to this request by returning a respond datagram. Recognition of the "Request-Respond" handshake in the logical message is done in the Tag field and is referred to as the handshake ID. The handshake ID is a unique ID and is returned by the communication server 112. The handshake ID value is within the range of 1 to 65535.

Synchronous data exchange is session oriented. During synchronous data exchange, a request message (it can be as the first message of the conversation) to open a "conversation" session is sent to the communication server 112 by the physical device. The communication server 112 creates a session and its session ID is returned. During the conversation time via this session, both the physical device and the communication server 112 keep the same session ID until either the physical device decides to close the conversation or there is a communications problem at the communication server 112. The session ID value is within the range of 1 to 32767 (2 bytes), where value 1 is a request to open a session and a negative value is a request to close a session. The value 0 is an invalid session ID.

The format of the logical message LMSG is as follows:

SID	Type	Tag	Src	Dst	API Message Body

SID represents a signature ID, that is calculated (CRC) from its header context. The field is used to recognize third party messages. The remaining fields support logical connectivity and the API data exchange mechanism.

Type is a message type indicator to recognize a data exchange mechanism. It reflects the manner between which two API components will cooperate.

Tag represents additional run-time information regarding to the type of the logical message. This tag ID is a unique conversation number between the two API components.

The datagram communication mechanism is as follows:

Tag ID = 0, means invalid session ID; and

Tag ID = 1 < Handshake ID < 65535.

The session (message) communication mechanism is as follows:

Tag ID = 0, means invalid session ID;

Tag ID = 1, means request to open session, or the first message;

Tag ID = 1, < Session ID < 32767 means a valid session; and

Tag ID = - 32767 < Session ID < -1, request to close a session, or the last message.

Src. is a logical address of the source and Dst. is a logical address of the destination.

The format of the API message AMSG is as follows:

EXT	D/M	Duplicate	Reserve	Reserve	b2	b1	b0

Ext is an extension bit to allow insertion of another header;

D/M is the datagram or message;

Duplicate is a logical message duplicate; and

b2, b1 and b0 are bits describing data exchange.

Figures 14 and 15 show communications connectivity between wireless terminals and host computers in the communication system 110 including the OSI model protocol stack and its conversions across the communications path.

Many wireless networks provide for "fleet connectivity" (one to many). Fleet connectivity cares only about the destination. This is a synchronous protocol. Between the communication server 112 and the WPDN switch 160, messages are routed via SVC's (switchable virtual circuits) located in the so called SVC SINK. SVC concept comes from the packet data networks (like X.25). The communication server 112 and the host computers communicate synchronously via dedicated SVCs. That means that a limited number of SVCs have to handle many wireless terminals. This traffic is handled by the communication server 112.

Communication server 112 enables three types of connectivity through the SVCs and enhances communication throughput, namely device connections, sessions connections and asynchronous datagram messaging. Asynchronous datagram messaging follows the dynamics of the traffic and accommodates any increase in the traffic. A limited number of SVCs provide throughput for a much larger number of wireless terminals. Device connection is permanent-static (terminal corresponds to the specific SVC). Session locks communication SINK only temporarily.

End-To-End Communications

For example, for a host computer to host computer connection through the communication server 112, the source host computer transmits an API message to the communication server 112 without any wrapping. After the API message passes through the virtual terminal 282, the API message as well as the virtual device ID of the virtual terminal 282 is sent to the preprocessor 300. As mentioned previously, the preprocessor attempts to extract the virtual device message header VDMSG_HDR and the logic message header LMSG_HDR from the API message. In this case, the preprocessor 300 recognizes that the API message does not include a virtual message header or a logical message header. The preprocessor 300 in turn analyzes the API message and interacts with the knowledge base 286 to determine the target logical connection ID for the API message. After the target logical connection ID is located, it is sent with the API message to the processor 302. The processor 302 passes the API message to the business processors therein which in turn process the message to ensure the API message protocol is compatible with that used by the destination host

computer. The processed API message is then passed to the postprocessor 304 with the target logical connection ID. The postprocessor uses the target logical connection ID as a key to search the knowledge base 286 for wrapping information. In this case, since the destination is a host computer, no wrapping is required. The postprocessor 304 in turn uses the target logical connection ID to find the destination virtual device, in this case the virtual terminal 282, and passes the API message to it. The virtual terminal 282 in turn passes the API message to the destination host computer over the land-line network 122.

If a wireless terminal 164 has established a connection with a host computer, logical messages generated by the wireless terminal are sent to a network provider that connects to the communication server 112 to the WPDN 36. Logical messages transmitted by the wireless terminal 164 to the host computer include a virtual device message header VDMSG_HDR. The logical message LMSG includes a logical message header LMSG_HDR and the API message. The messages received by the virtual host 280 from the wireless terminal 164 are passed to the preprocessor 300. The preprocessor 300 extracts both the virtual device message header VDMSG_HDR and the logical message header LMSG_HDR from the API message. The preprocessor 300 then analyzes the virtual device message header for the source physical device ID. It then uses the physical device ID as a key to search the knowledge base 286 for the registered target logical connection ID. If there is more than one target logical connection ID in the knowledge base 286 registered with the physical device ID, then the preprocessor 300 analyzes the logic message header LMSG_HDR to determine the source and destination logical IDs. This information is then used to search the knowledge base 286 to determine the target logical connection ID. After the target logical connection ID is located, the target logical connection ID is sent to the processor 302 together with the API message. The business processors in the processor in turn process the API message as described previously. The processed API message is then passed to the postprocessor 304 together with the target logical connection ID. The postprocessor 304 uses the target logical connection ID as a key to search the knowledge base 286 for wrapping information. In this case, since the destination is a host computer, no wrapping is required. The postprocessor 304 in turn uses the logical connection ID to find the target virtual device, in this case

the virtual terminal 282, and passes the message to it. The virtual terminal 282 in turn passes the API message to the destination host computer over the land-line network 122.

If a wireless terminal 164 is communicating with another wireless terminal, messages are sent from the source wireless terminal through the WPDN 120 to the communication server 112. Since a wireless terminal is transmitting messages, the virtual host 280 receives virtual device messages which include a virtual device message header and a logical message. The logical message includes a logical message header and the API message. The message is processed in the manner described above by the preprocessor 300 and the processor 302. However, when the postprocessor 304 receives the target logical connection ID and the processed API message, it uses the target logical connection ID as a key to search the knowledge base 286 for wrapping information. In this case, since the destination is a wireless terminal, both logical message and virtual device message wrapping are required. The postprocessor 304 in turn receives the wrapping information from the knowledge base and wraps the API message in the appropriate manner before passing the wrapped message to the virtual host 280 for transmission over the WPDN 120 to the destination wireless terminal.

Those of skill in the art will appreciate that the present invention provides advantages in that communications connectivity between physical devices is maintained even though the networks to which the physical devices are connected implement different API protocols.

Although a preferred embodiment of the present invention has been described, those of skill in the art will appreciate that variations and modifications may be made without departing from the spirit and scope thereof as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A communication system comprising:

at least two communication networks over which communications between physical devices connected to said communication networks are to be carried, said communication networks implementing different protocols for messaging; and

a communication server acting between said communication networks and through which messages transmitted between said communication networks pass, said communication server including a knowledge base storing protocol conversion information, said communication server accessing said protocol conversion information in said knowledge base upon receipt of a message and converting the protocol thereof to a protocol compatible with the communication network to which said message is being sent.

2. A communication system as defined in claim 1 wherein said communication server includes virtual devices communicating with said communication networks and a virtual gateway bridging said virtual networks, said virtual gateway accessing said knowledge base and converting protocols of said messages.

3. A communication system as defined in claim 2 wherein said virtual gateway includes a preprocessor, a processor and a postprocessor, said preprocessor examining each incoming message to locate target logical connection information determining the target destination for said incoming message, said processor converting the protocol of each incoming message, where appropriate, based on said target logical connection information, said postprocessor wrapping each message received from said processor with headers, where appropriate.

4. A communication system as defined in any of the preceding claims wherein one of said communication networks is a wireless network and wherein one of said communication networks is a wired land-line network.

5. A communication system as defined in claim 4 wherein messages transmitted over said wireless network, include API messages to be processed by destination physical devices and target logical connection information specifying the destinations for said API messages.

6. A communication system as defined in claim 5 wherein said target logical connection information is including in a logical message header wrapping said API message.

7. A communication system as defined in claim 6 wherein said preprocessor strips the logical message header from said API message upon receipt of a message from said wireless network and uses said logical message header as a key to search said knowledge base for said protocol conversion information.

8. A communication system as defined in claim 7 wherein said preprocessor analyzes the API message of a message received from said wireless network for said target logical connection information if said target logical connection information cannot be determined from said logical message header.

9. A communication system as defined in any one of claims 4 to 8 wherein messages transmitted over said land-line network are in the form of API messages, said preprocessor analyzing the API message of a message received from said land-line network for said target logical connection information.

10. A communication server to act as a gateway for the transmission of messages between two virtual devices communicating with networks implementing different protocols, said communication server comprising:

a knowledge base storing protocol conversion information to convert messages of one protocol to a different protocol; and

a virtual gateway accessing said protocol conversion information upon receipt of a message to be transmitted between said virtual devices and converting the

protocol of said message to a protocol compatible with the network to which said message is being sent.

11. A communication server as defined in claim 10 wherein said virtual gateway includes a preprocessor, a processor and a postprocessor, said preprocessor examining each incoming message to locate target logical connection information determining the target destination for said incoming message, said processor converting the protocol of each incoming message, where appropriate, based on said target logical connection information, said postprocessor wrapping each message received from said processor with headers, where appropriate.

12. A communication server as defined in claim 11 further including a tool kit to setup said knowledge base with said protocol conversion information.

13. A communication server as defined in claim 12 wherein said virtual gateway updates said protocol conversion information based on message traffic therethrough.

14. A communication server as defined in claim 11 wherein said preprocessor unwraps headers accompanying each incoming message and uses said headers as keys to search said knowledge base for said protocol conversion information.

15. A communication server as defined in claim 14 wherein said preprocessor analyzes the message for said target logical connection information if said target logical connection information cannot be determined from said headers.

16. A communication system comprising:

a wireless network;

at least one wireless terminal to transmit messages over said wireless network;

a land-line network;

at least one host computer connected to said land-line network to transmit messages over said land-line network; and

a communication server providing communications connectivity for messages to be transmitted from one network to the other, wherein said at least one wireless terminal and said communication server include registries, said registries including mapping information to map physically said at least one wireless terminal to said land-line network to enable messages transmitted by said at least one wireless terminal to be delivered to said at least one host computer.

17. A communication system as defined in claim 16 wherein the registry in said at least one wireless terminal maps drivers and port of said wireless terminal to ports of said communication server.

18. A communication system as defined in claim 17 wherein the registry in said communication server maps logical connections between said wireless and land-line networks.

19. A communication system as defined in any one of claims 16 to 18 wherein said communication server includes a knowledge base storing protocol conversion information, said communication server accessing said protocol conversion information in said knowledge base upon receipt of a message and converting the protocol thereof to a protocol compatible with the network to which said message is being sent.

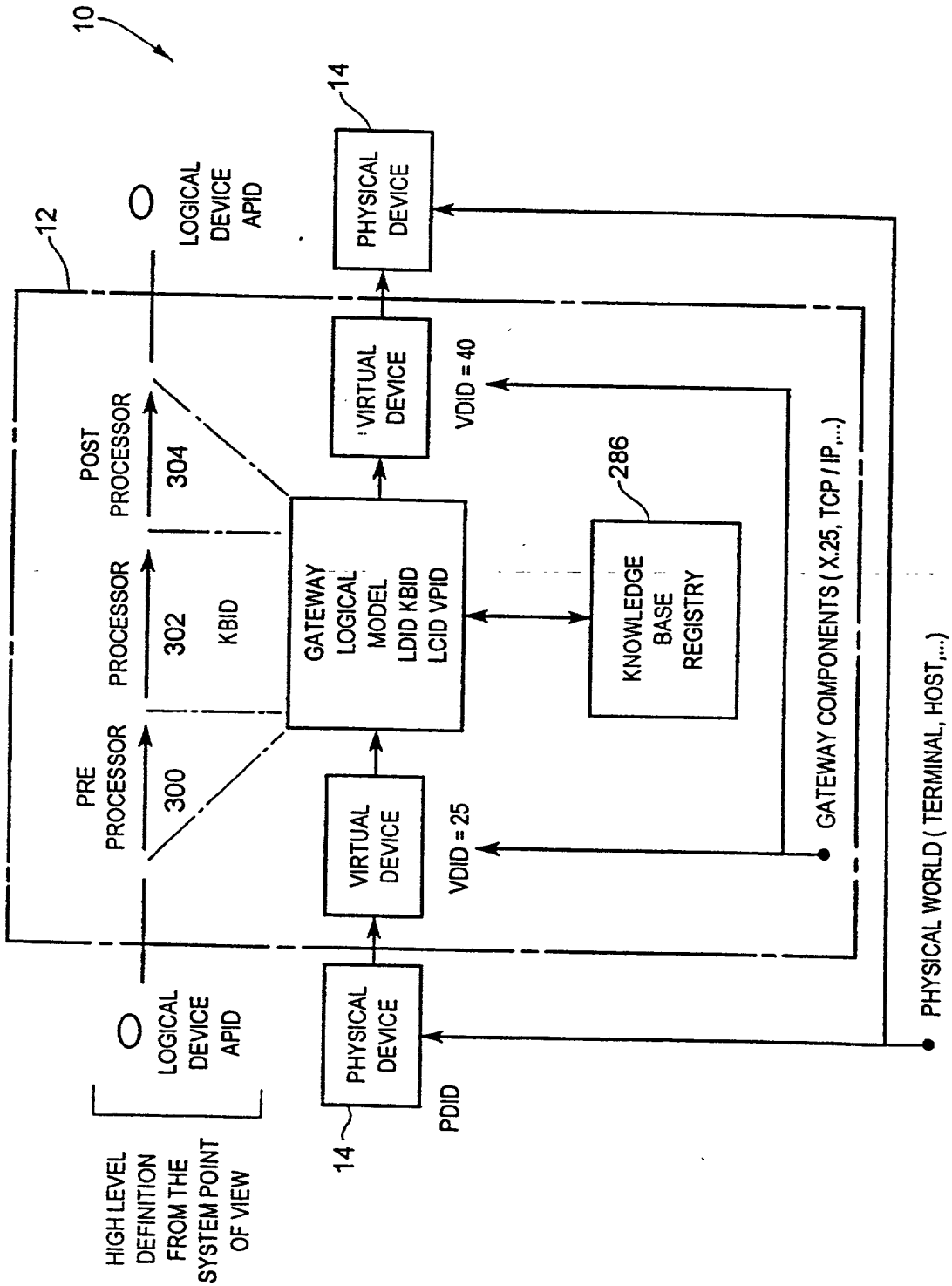
10
12
14
LOGICAL DEVICE APID
PHYSICAL DEVICE
VIRTUAL DEVICE
VDID = 40
POST PROCESSOR
304
PROCESSOR
302
KBID
PRE PROCESSOR
300
GATEWAY LOGICAL MODEL LDID KBID LCID VPID
286
KNOWLEDGE BASE REGISTRY
VIRTUAL DEVICE
VDID = 25
GATEWAY COMPONENTS (X.25, TCP / IP,...)
PHYSICAL WORLD (TERMINAL, HOST,...)
LOGICAL DEVICE APID
PHYSICAL DEVICE
PDID
14
HIGH LEVEL DEFINITION FROM THE SYSTEM POINT OF VIEW

FIG. 1

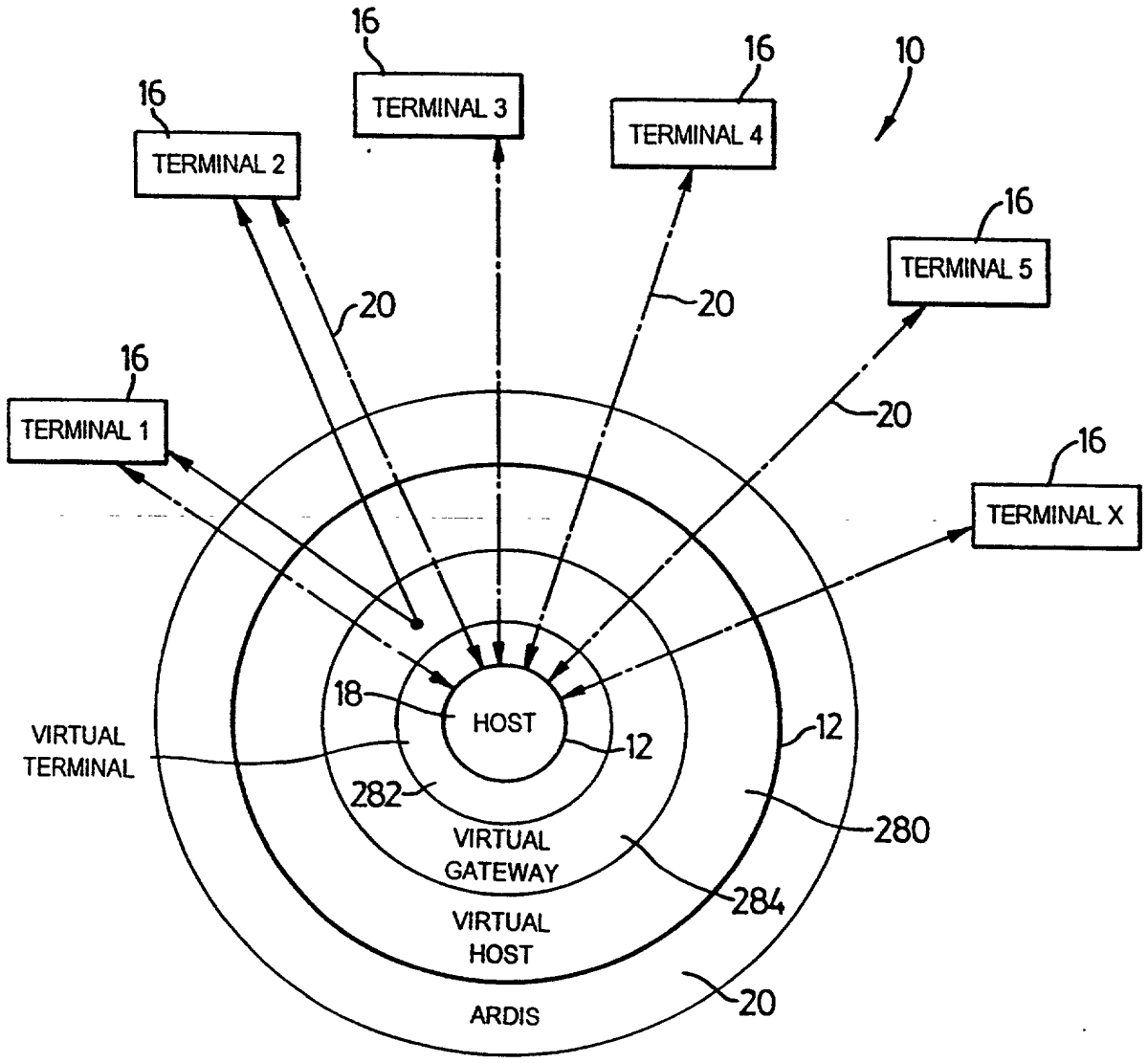
16
TERMINAL 3
16
TERMINAL 4
10
16
TERMINAL 2
16
TERMINAL 5
20
20
16
TERMINAL 1
20
16
TERMINAL X
18
HOST
12
12
VIRTUAL
TERMINAL
282
280
VIRTUAL
GATEWAY
284
VIRTUAL
HOST
20
ARDIS

FIG. 2

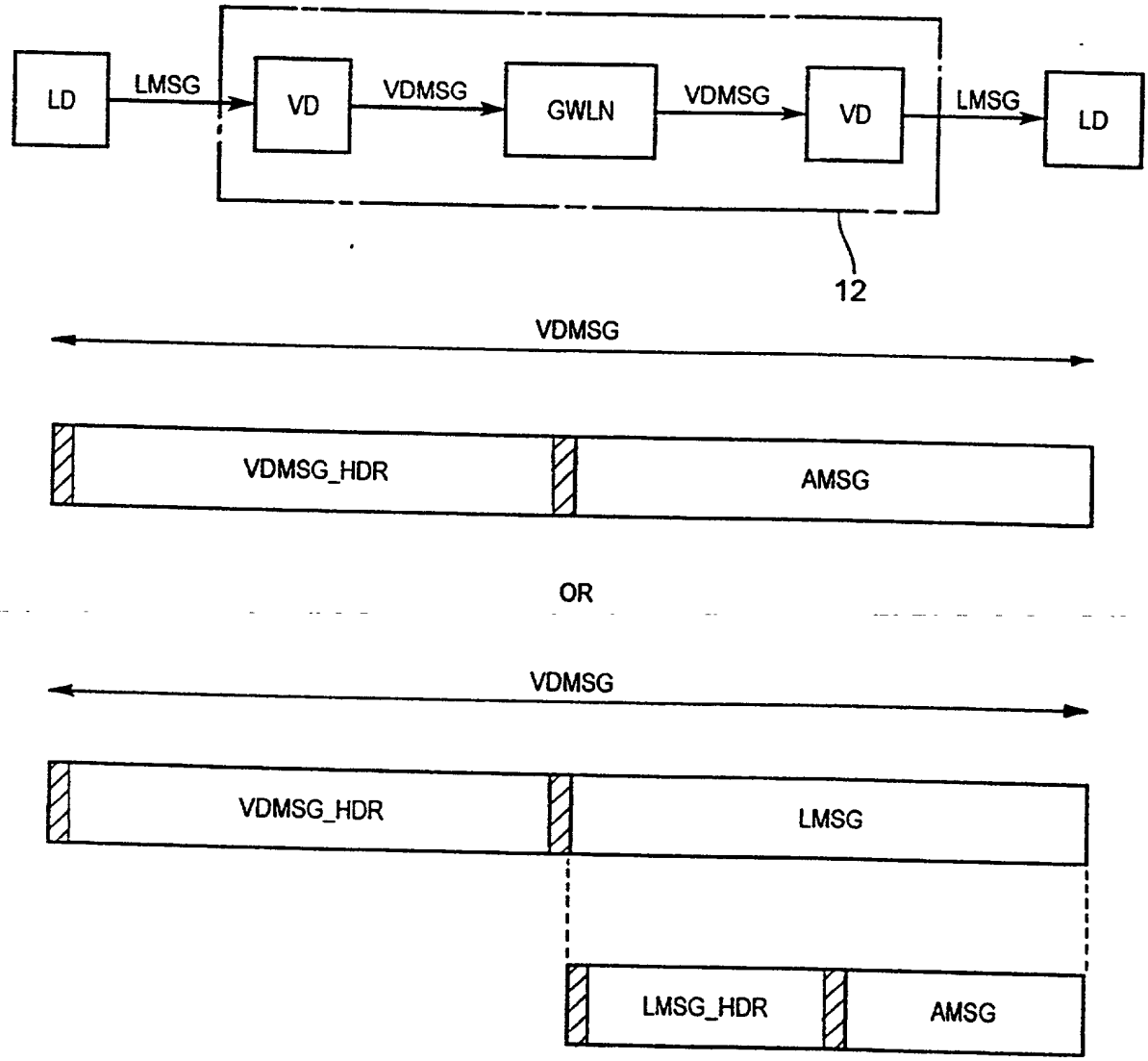
LD
LMSG
VD
VDMSG
GWLN
VDMSG
VD
LMSG
LD
12
VDMSG
VDMSG_HDR
AMSG
OR
VDMSG
VDMSG_HDR
LMSG
LMSG_HDR
AMSG
HANDLE BY PROCESSOR (PRE-PROCESSOR)
HANDLE BY BUSINESS PROCESSOR

FIG. 3

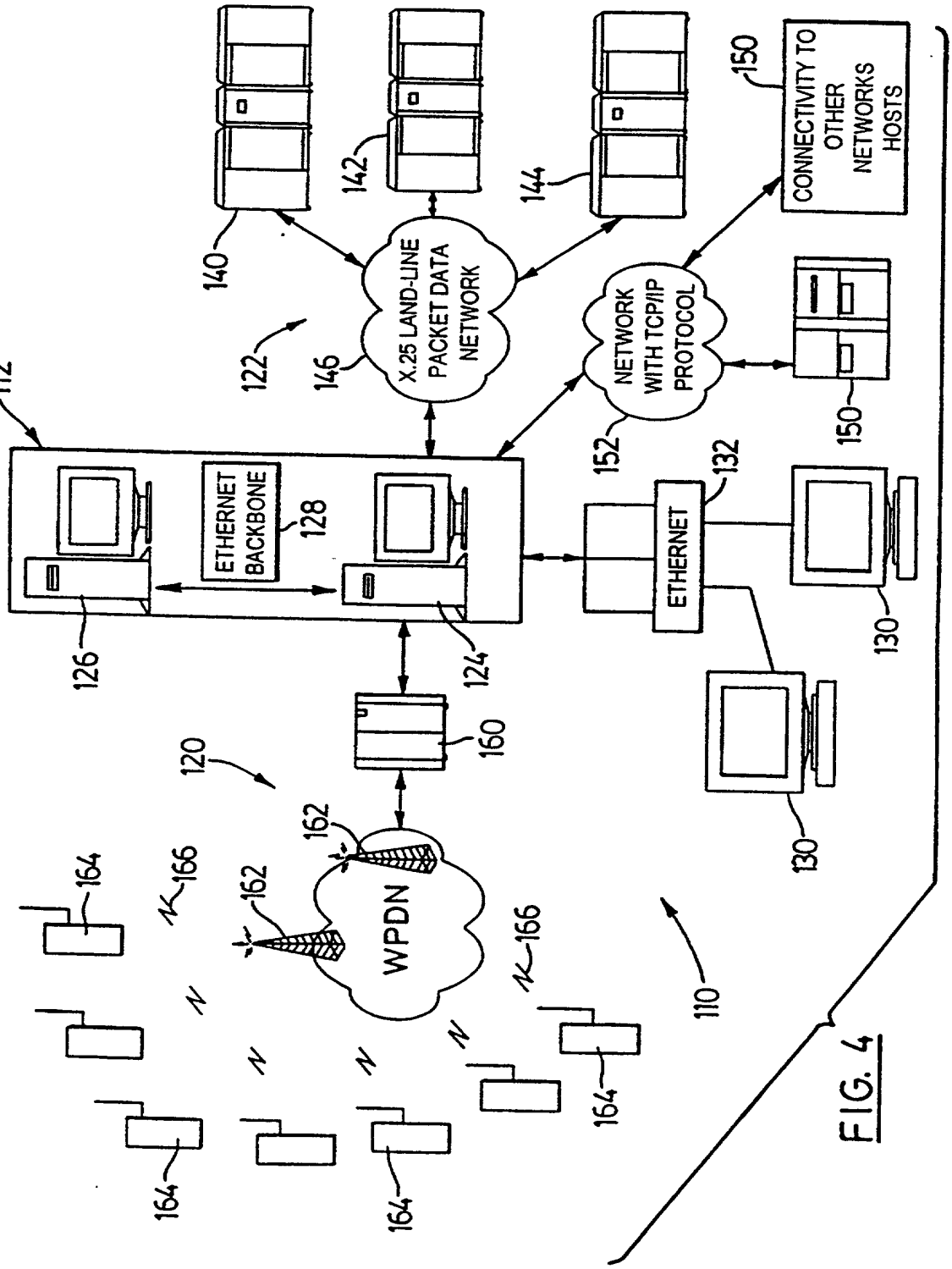
CONNECTIVITY TO OTHER NETWORKS HOSTS
X.25 LAND-LINE PACKET DATA NETWORK
NETWORK WITH TCP/IP PROTOCOL
ETHERNET BACKBONE
ETHERNET
WPDN
140
142
144
146
122
150
152
112
126
124
128
132
130
160
120
162
164
166
110

FIG. 4

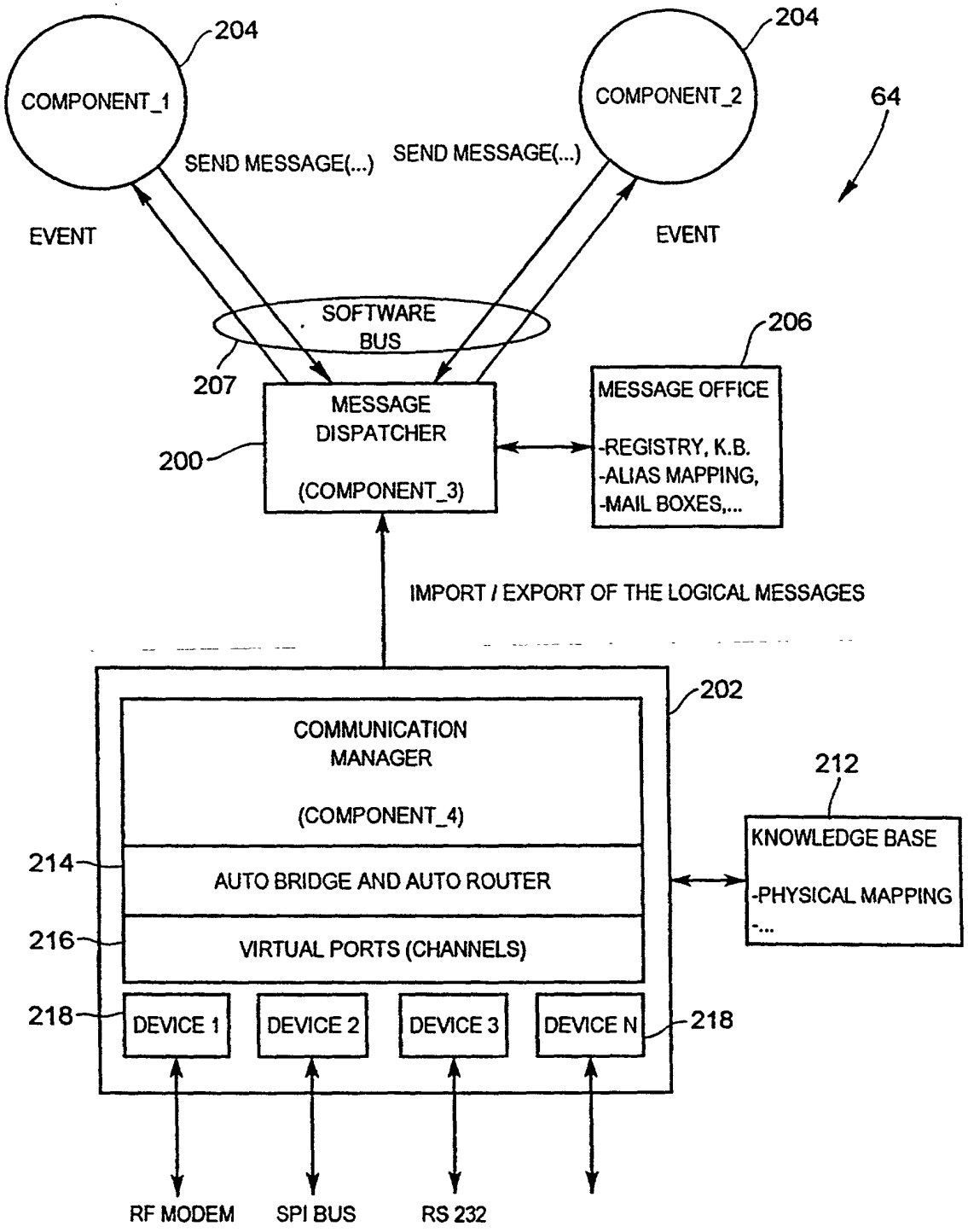
204
COMPONENT_1
204
COMPONENT_2
64
SEND MESSAGE(...)
SEND MESSAGE(...)
EVENT
EVENT
SOFTWARE BUS
207
206
MESSAGE DISPATCHER
(COMPONENT_3)
200
MESSAGE OFFICE
-REGISTRY, K.B.
-ALIAS MAPPING,
-MAIL BOXES,...
IMPORT / EXPORT OF THE LOGICAL MESSAGES
202
COMMUNICATION MANAGER
(COMPONENT_4)
212
KNOWLEDGE BASE
-PHYSICAL MAPPING
-...
214
AUTO BRIDGE AND AUTO ROUTER
216
VIRTUAL PORTS (CHANNELS)
218
DEVICE 1
DEVICE 2
DEVICE 3
DEVICE N
218
RF MODEM
SPI BUS
RS 232

FIG. 5

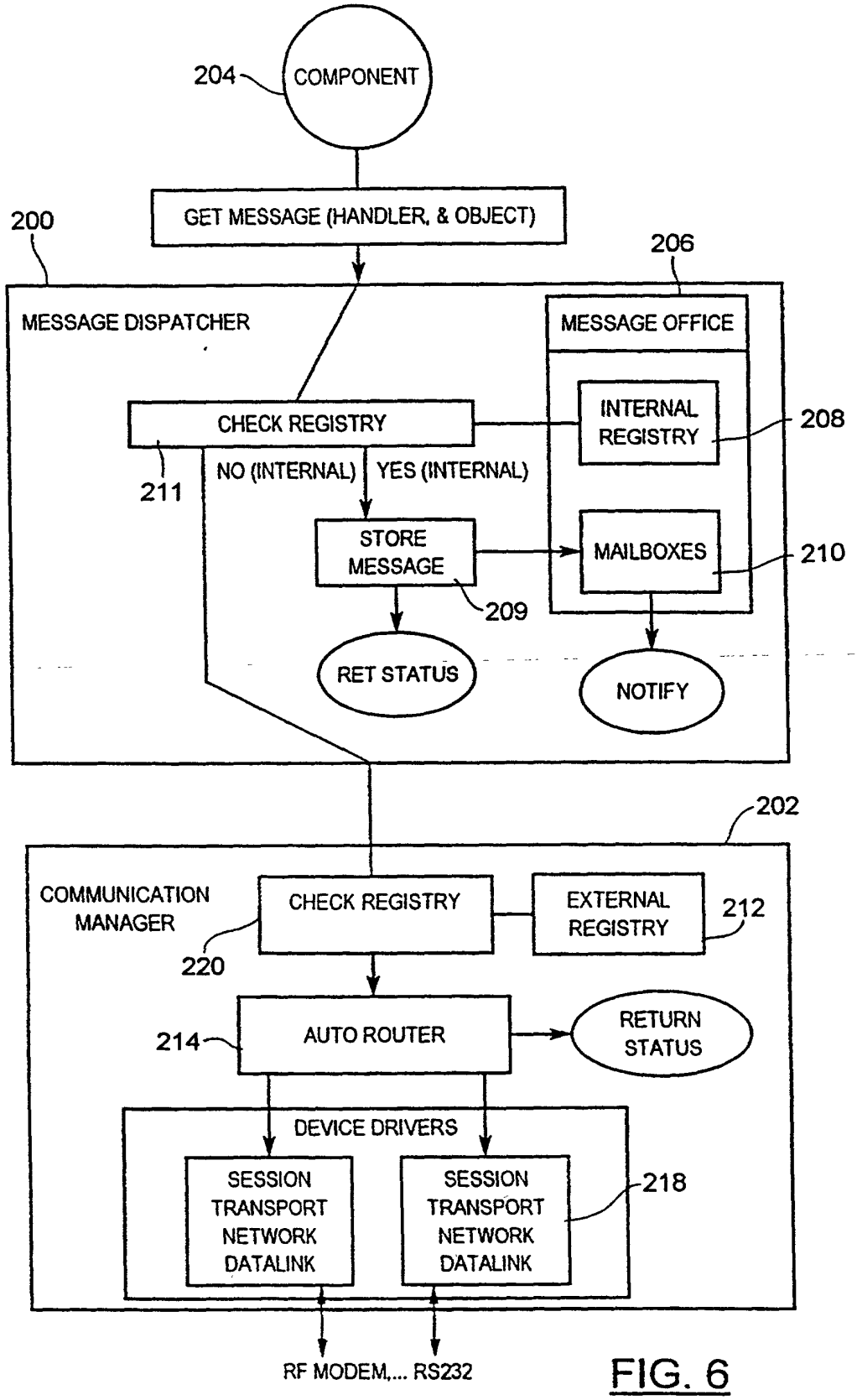
204
COMPONENT
GET MESSAGE (HANDLER, & OBJECT)
200
206
MESSAGE DISPATCHER
MESSAGE OFFICE
CHECK REGISTRY
INTERNAL REGISTRY
208
211
NO (INTERNAL)
YES (INTERNAL)
STORE MESSAGE
MAILBOXES
210
209
RET STATUS
NOTIFY
202
COMMUNICATION MANAGER
CHECK REGISTRY
EXTERNAL REGISTRY
212
220
214
AUTO ROUTER
RETURN STATUS
DEVICE DRIVERS
SESSION TRANSPORT NETWORK DATALINK
SESSION TRANSPORT NETWORK DATALINK
218
RF MODEM,... RS232

FIG. 6

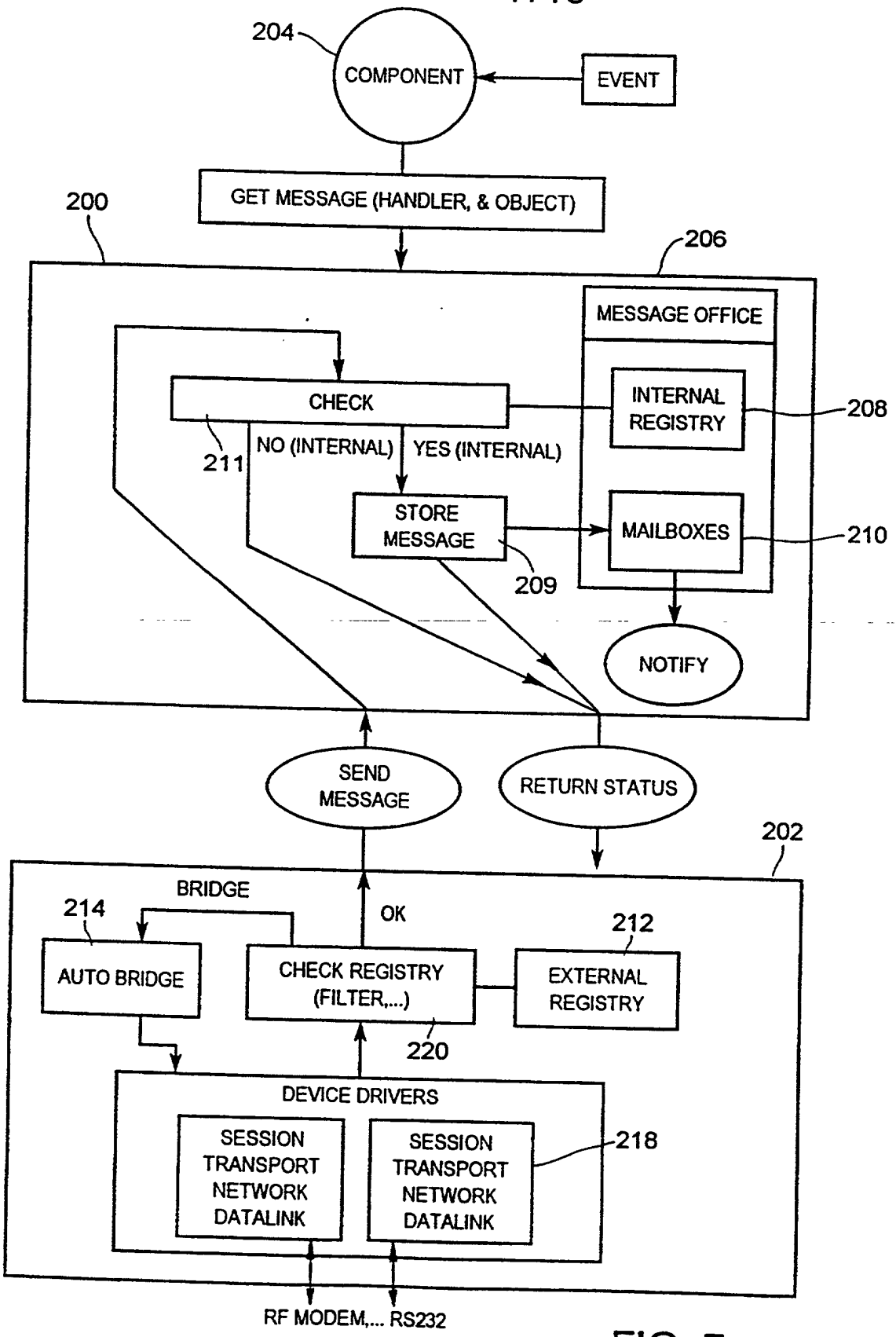
204
COMPONENT
EVENT
GET MESSAGE (HANDLER, & OBJECT)
200
206
MESSAGE OFFICE
CHECK
INTERNAL REGISTRY
208
211
NO (INTERNAL)
YES (INTERNAL)
STORE MESSAGE
MAILBOXES
210
209
NOTIFY
SEND MESSAGE
RETURN STATUS
202
BRIDGE
214
OK
212
AUTO BRIDGE
CHECK REGISTRY (FILTER,...)
EXTERNAL REGISTRY
220
DEVICE DRIVERS
SESSION TRANSPORT NETWORK DATALINK
SESSION TRANSPORT NETWORK DATALINK
218
RF MODEM,... RS232

FIG. 7

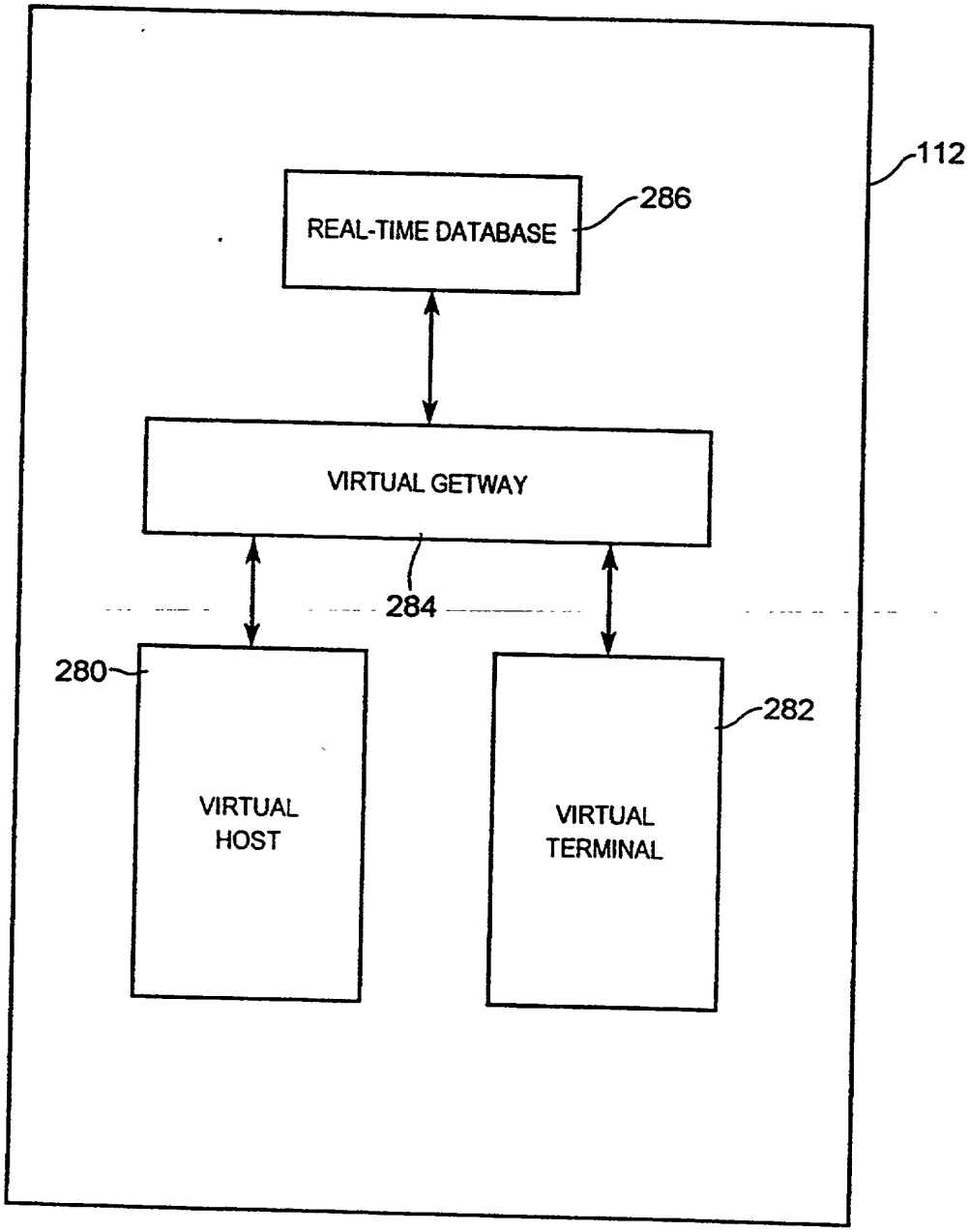
112
REAL-TIME DATABASE
286
VIRTUAL GETWAY
284
280
VIRTUAL HOST
282
VIRTUAL TERMINAL

FIG. 8

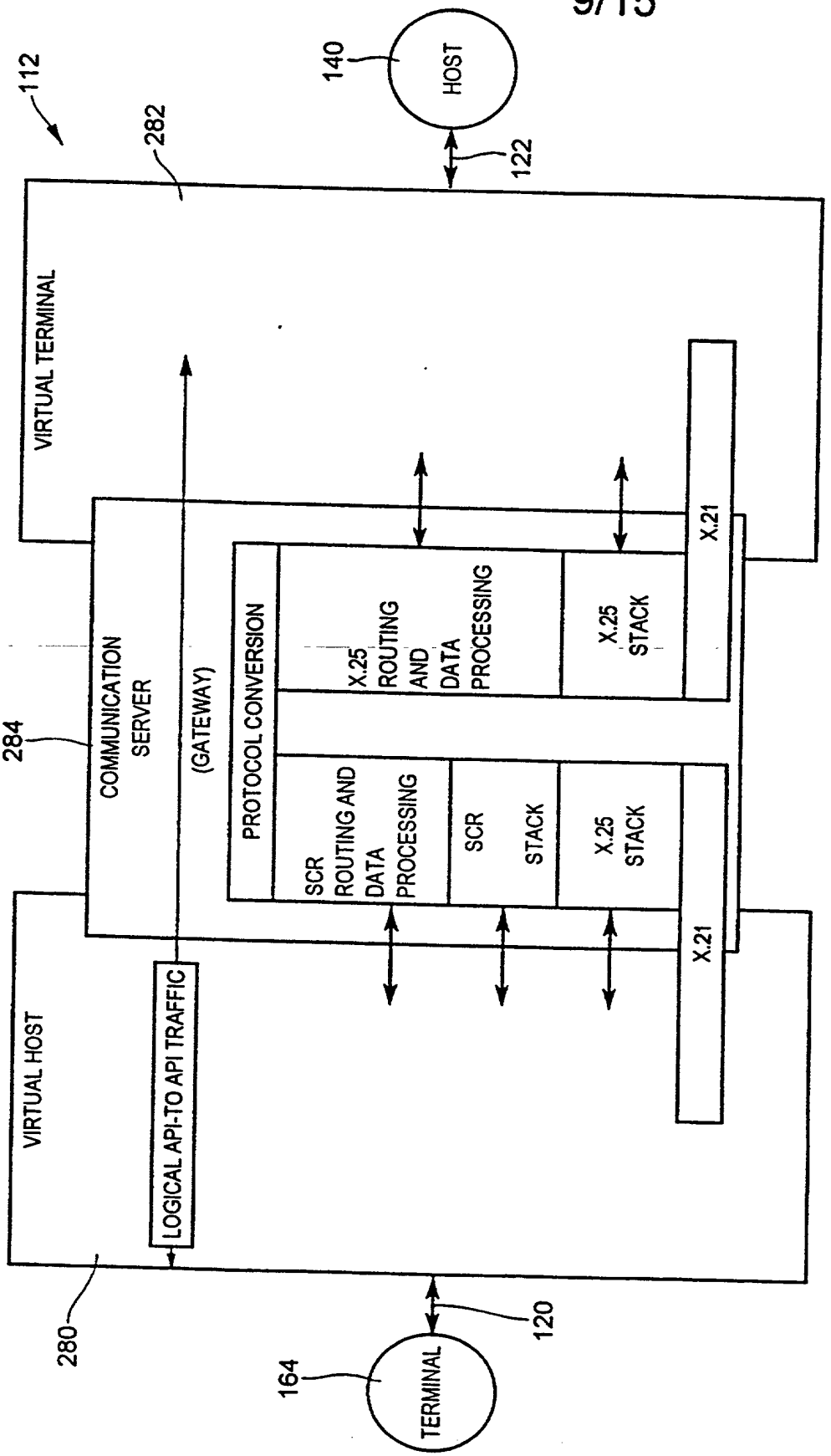
112
282
140
HOST
122
VIRTUAL TERMINAL
284
COMMUNICATION SERVER
(GATEWAY)
PROTOCOL CONVERSION
X.25 ROUTING AND DATA PROCESSING
X.25 STACK
X.21
SCR ROUTING AND DATA PROCESSING
SCR STACK
X.25 STACK
X.21
VIRTUAL HOST
LOGICAL API-TO API TRAFFIC
280
120
164
TERMINAL

FIG. 9

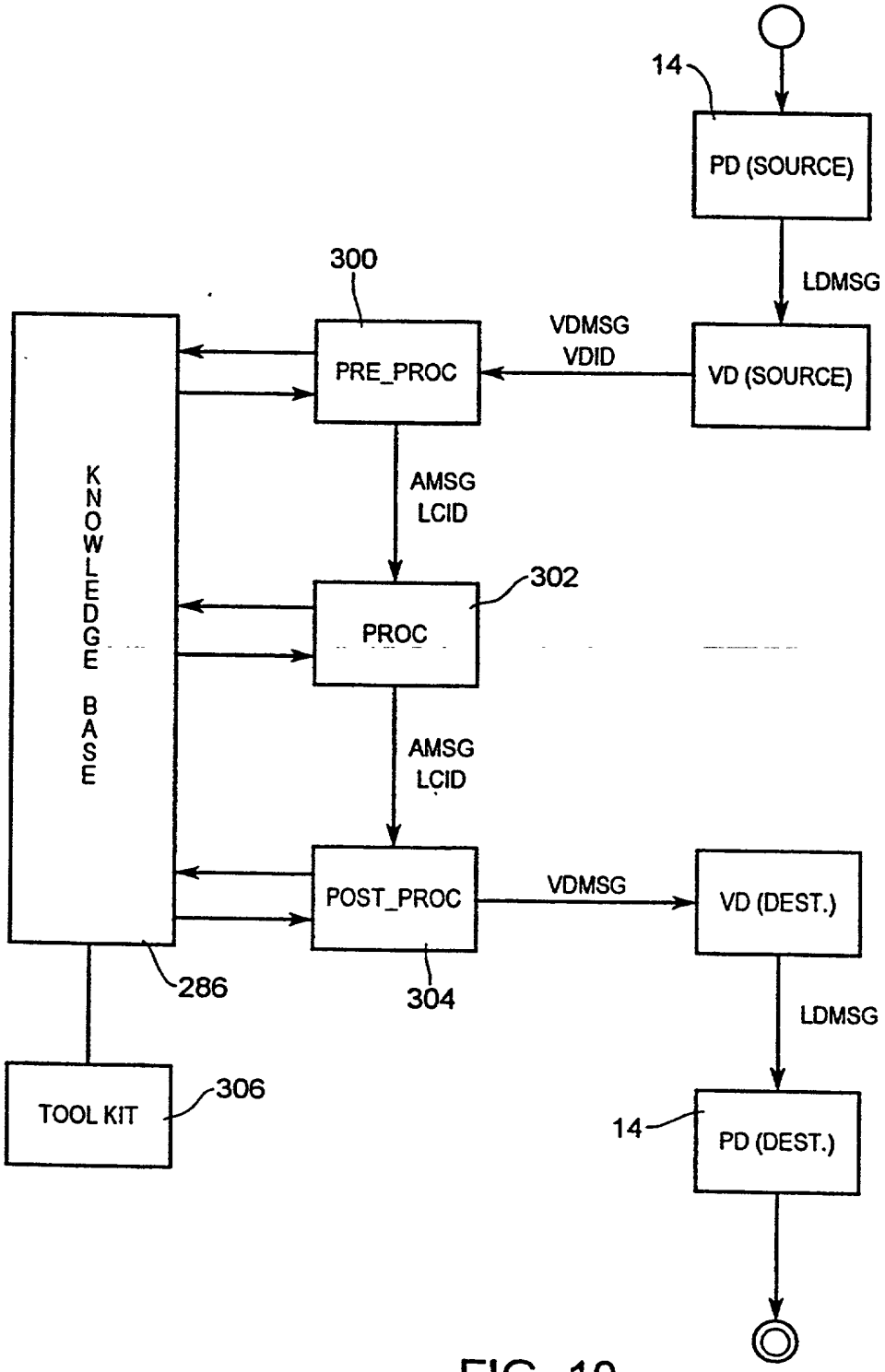
14
PD (SOURCE)
LDMSG
300
VDMSG
VDID
PRE_PROC
VD (SOURCE)
KNOWLEDGE BASE
AMSG
LCID
302
PROC
AMSG
LCID
POST_PROC
VDMSG
VD (DEST.)
286
304
LDMSG
TOOL KIT
306
14
PD (DEST.)

FIG. 10

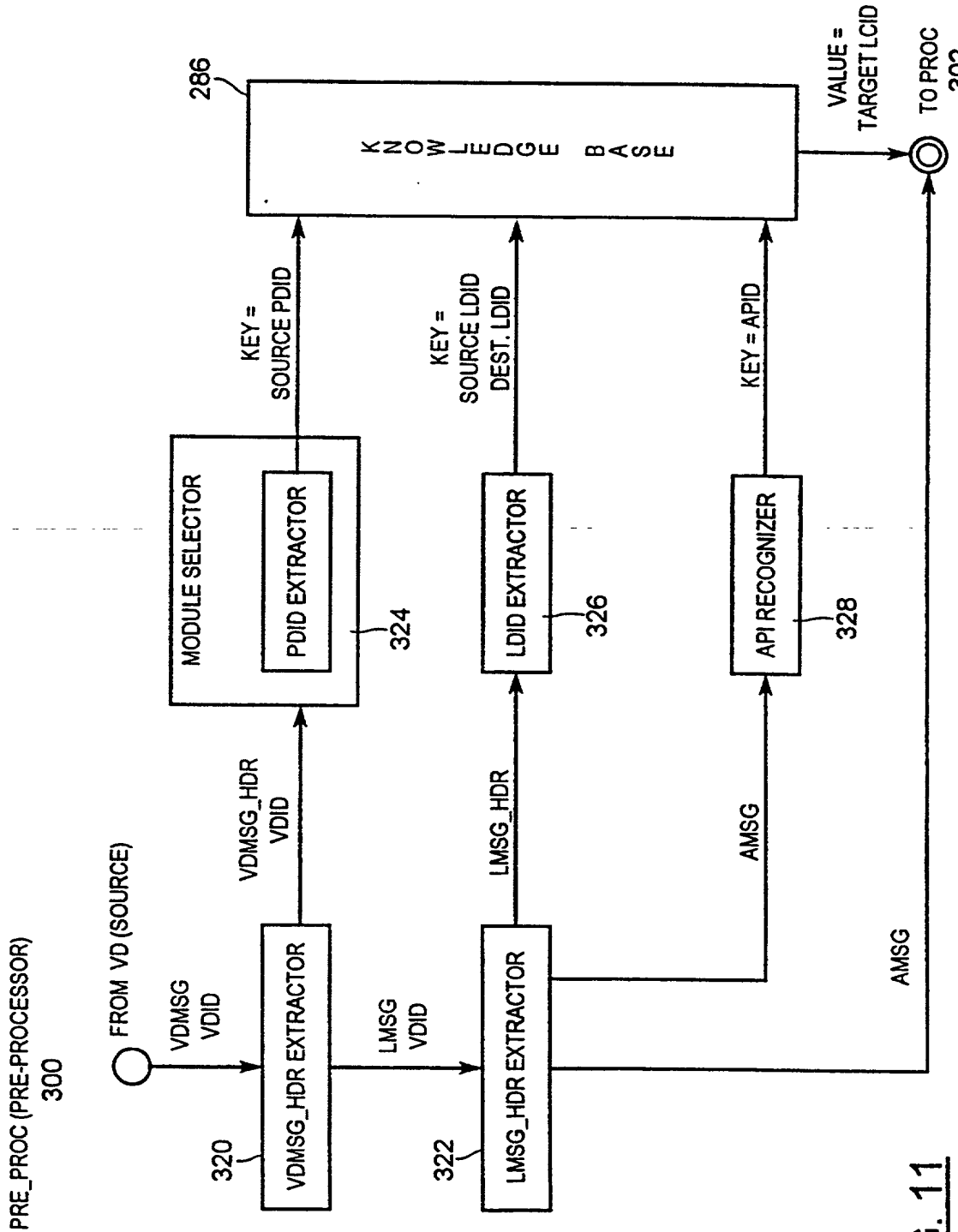
PRE_PROC (PRE-PROCESSOR)
300
FROM VD (SOURCE)
VDMSG
VDID
VDMSG_HDR EXTRACTOR
320
VDMSG_HDR
VDID
MODULE SELECTOR
PDID EXTRACTOR
324
KEY =
SOURCE PDID
LMSG
VDID
LMSG_HDR EXTRACTOR
322
LMSG_HDR
LDID EXTRACTOR
326
KEY =
SOURCE LDID
DEST. LDID
AMSG
API RECOGNIZER
328
KEY = APID
AMSG
286
KNOWLEDGE BASE
VALUE =
TARGET LCID
TO PROC
302

FIG. 11

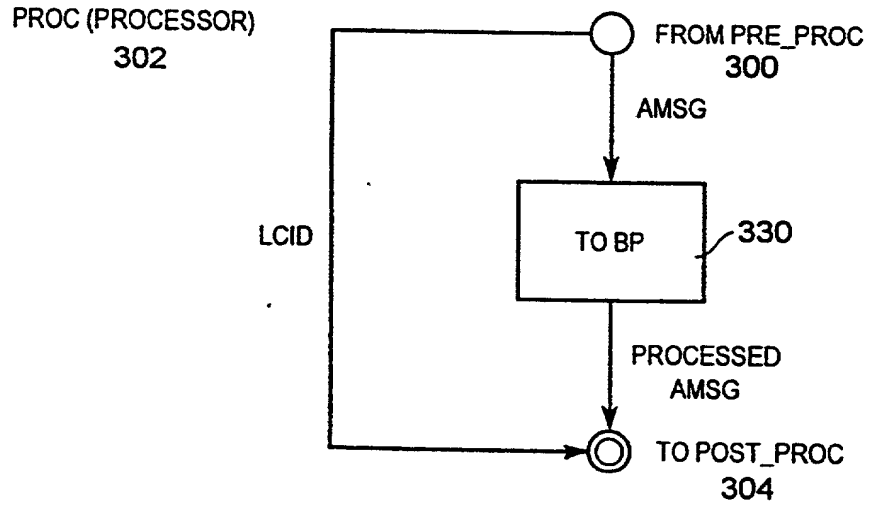
PROC (PROCESSOR)
302
FROM PRE_PROC
300
AMSG
LCID
TO BP
330
PROCESSED
AMSG
TO POST_PROC
304

FIG.12

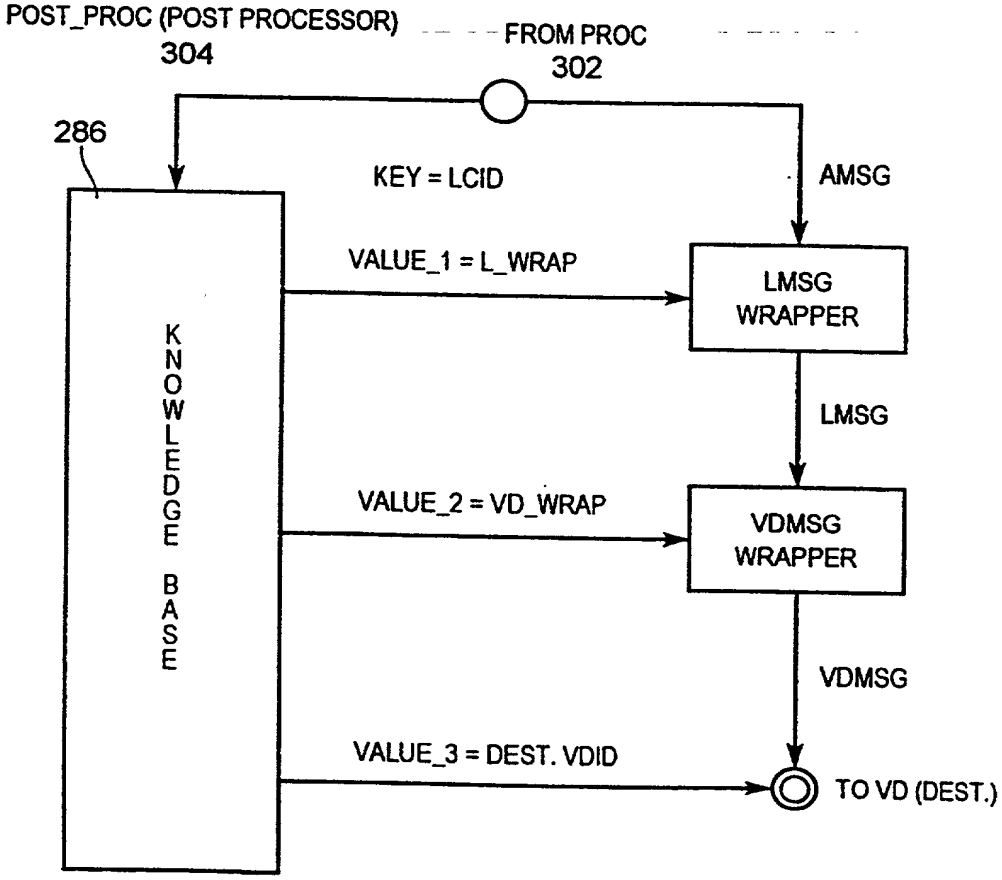
POST_PROC (POST PROCESSOR)
304
FROM PROC
302
286
KEY = LCID
AMSG
VALUE_1 = L_WRAP
LMSG
WRAPPER
LMSG
VALUE_2 = VD_WRAP
VDMSG
WRAPPER
VDMSG
VALUE_3 = DEST. VDID
TO VD (DEST.)
KNOWLEDGE BASE

FIG. 13

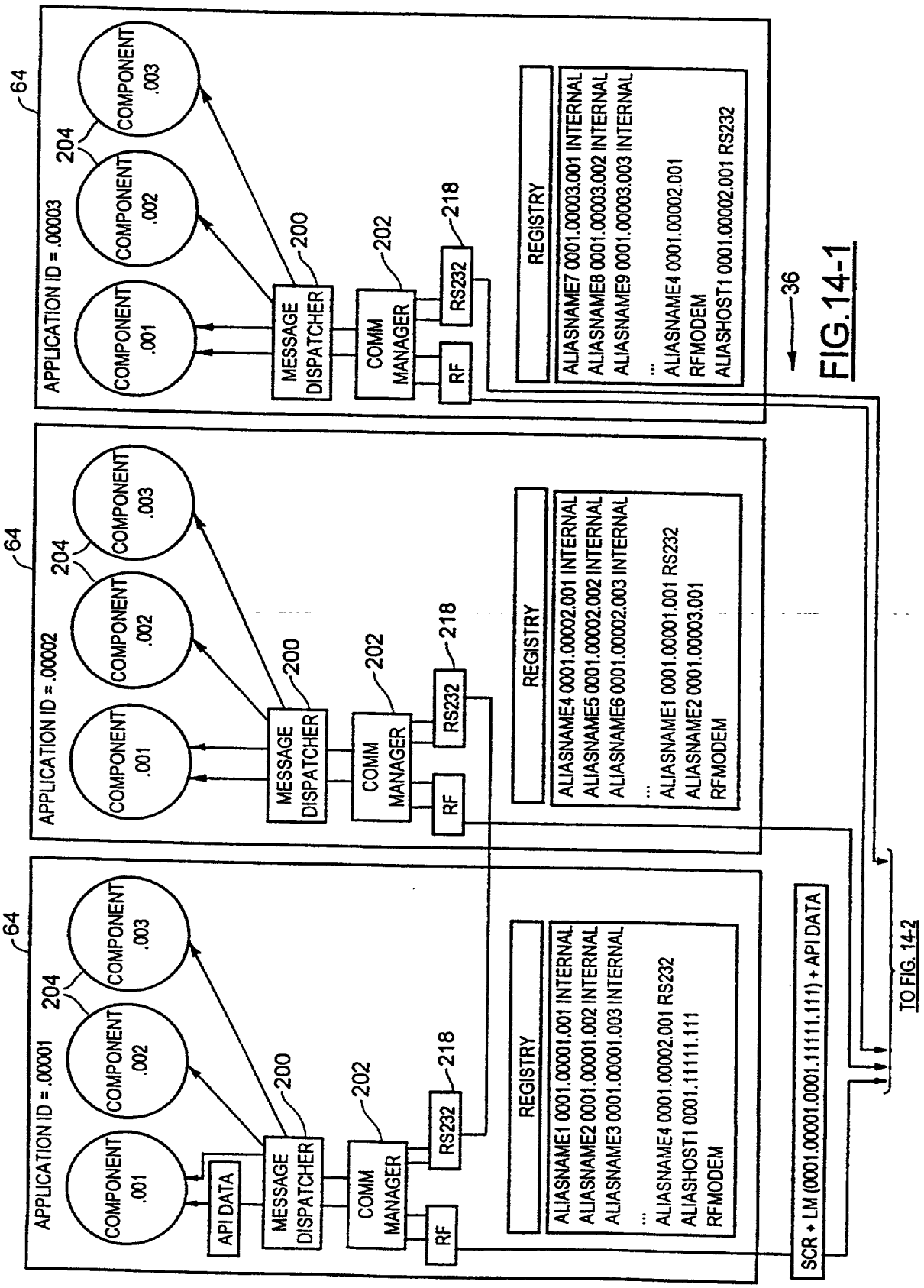
64
APPLICATION ID = .00003
COMPONENT .001
COMPONENT .002
COMPONENT .003
204
MESSAGE DISPATCHER
200
COMM MANAGER
202
RF
RS232
218
REGISTRY
ALIASNAME7 0001.00003.001 INTERNAL
ALIASNAME8 0001.00003.002 INTERNAL
ALIASNAME9 0001.00003.003 INTERNAL
...
ALIASNAME4 0001.00002.001
RFMODEM
ALIASHOST1 0001.00002.001 RS232
36
APPLICATION ID = .00002
ALIASNAME4 0001.00002.001 INTERNAL
ALIASNAME5 0001.00002.002 INTERNAL
ALIASNAME6 0001.00002.003 INTERNAL
ALIASNAME1 0001.00001.001 RS232
ALIASNAME2 0001.00003.001
APPLICATION ID = .00001
API DATA
ALIASNAME1 0001.00001.001 INTERNAL
ALIASNAME2 0001.00001.002 INTERNAL
ALIASNAME3 0001.00001.003 INTERNAL
ALIASNAME4 0001.00002.001 RS232
ALIASHOST1 0001.11111.111
SCR + LM (0001.00001.0001.11111.111) + API DATA
TO FIG. 14-2

FIG.14-1

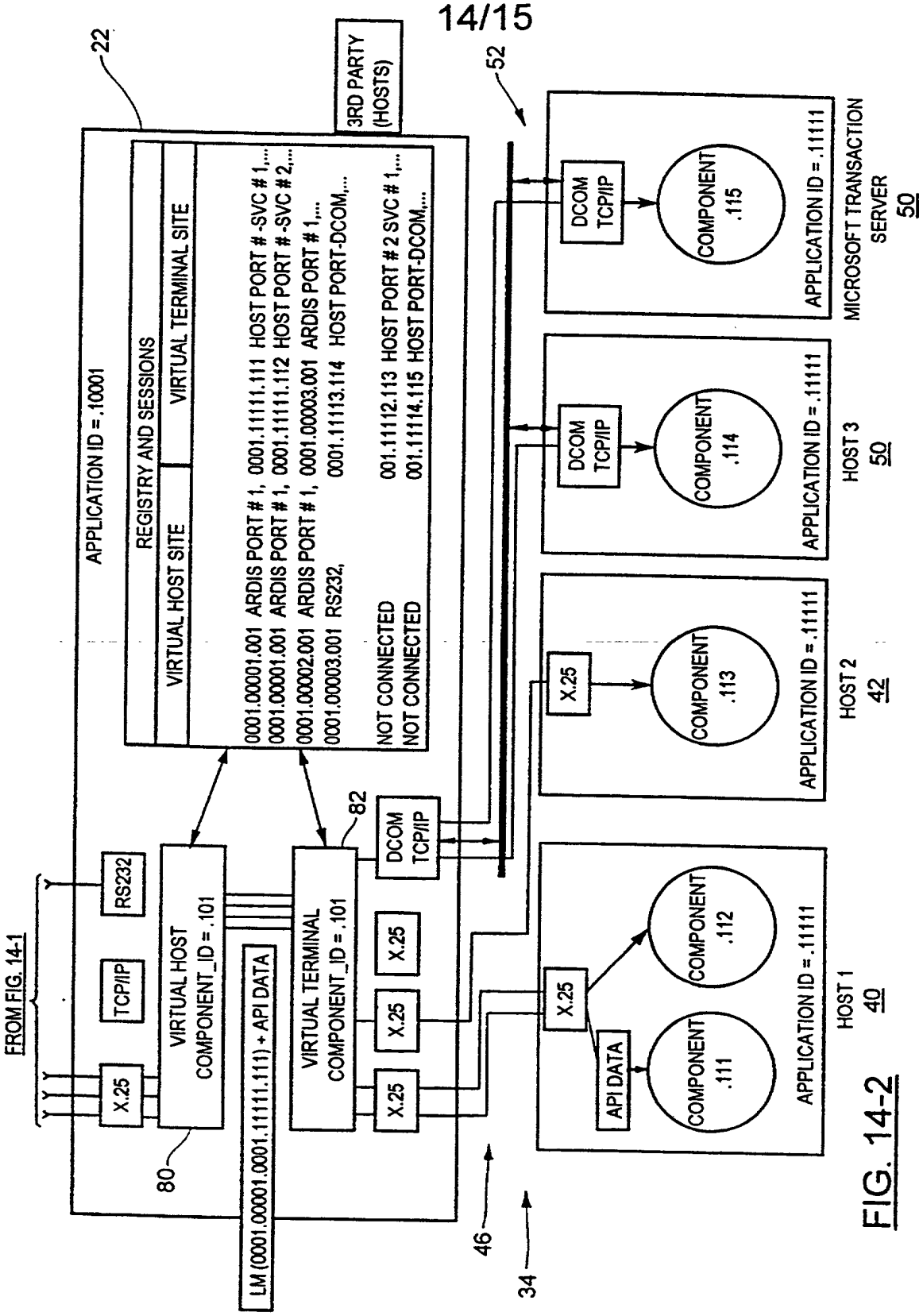
22
3RD PARTY (HOSTS)
52
APPLICATION ID = .10001
REGISTRY AND SESSIONS
VIRTUAL HOST SITE
VIRTUAL TERMINAL SITE
0001.00001.001 ARDIS PORT # 1, 0001.11111.111 HOST PORT # -SVC # 1,...
0001.00001.001 ARDIS PORT # 1, 0001.11111.112 HOST PORT # -SVC # 2,...
0001.00002.001 ARDIS PORT # 1, 0001.00003.001 ARDIS PORT # 1,...
0001.00003.001 RS232, 0001.11113.114 HOST PORT-DCOM,...
NOT CONNECTED 001.11112.113 HOST PORT # 2 SVC # 1,...
NOT CONNECTED 001.11114.115 HOST PORT-DCOM,...
FROM FIG. 14-1
RS232
TCP/IP
X.25
VIRTUAL HOST COMPONENT_ID = .101
80
LM (0001.00001.0001.11111.111) + API DATA
VIRTUAL TERMINAL COMPONENT_ID = .101
82
DCOM TCP/IP
X.25
X.25
X.25
46
34
DCOM TCP/IP
COMPONENT .115
APPLICATION ID = .11111
MICROSOFT TRANSACTION SERVER 50
DCOM TCP/IP
COMPONENT .114
APPLICATION ID = .11111
HOST 3 50
X.25
COMPONENT .113
APPLICATION ID = .11111
HOST 2 42
X.25
COMPONENT .112
API DATA
COMPONENT .111
APPLICATION ID = .11111
HOST 1 40

FIG. 14-2

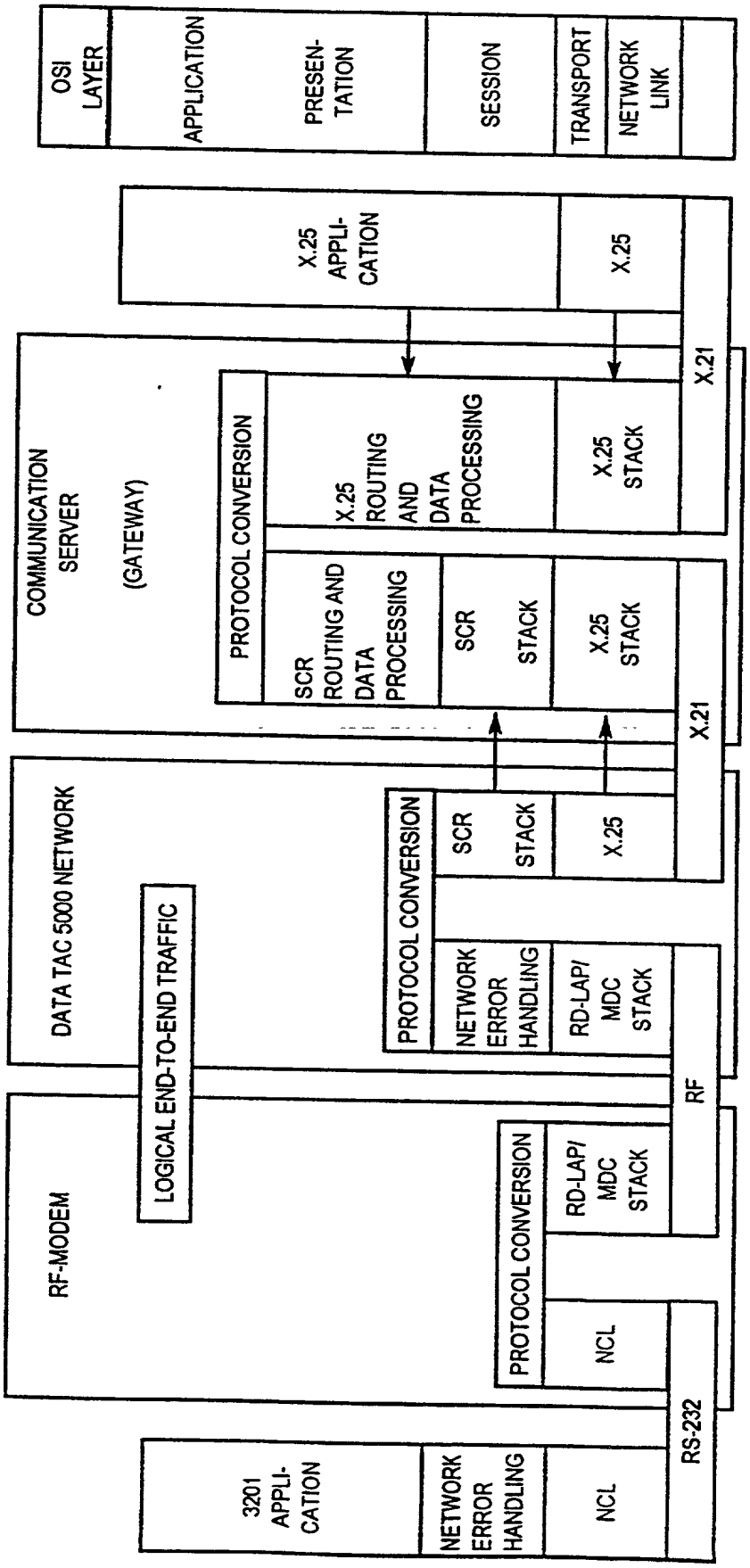
OSI LAYER
APPLICATION
PRESEN-TATION
SESSION
TRANSPORT
NETWORK LINK
X.25 APPLI-CATION
X.25
X.21
COMMUNICATION SERVER
(GATEWAY)
PROTOCOL CONVERSION
X.25 ROUTING AND DATA PROCESSING
X.25 STACK
SCR ROUTING AND DATA PROCESSING
SCR STACK
X.25 STACK
X.21
DATA TAC 5000 NETWORK
PROTOCOL CONVERSION
SCR STACK
X.25
X.21
LOGICAL END-TO-END TRAFFIC
NETWORK ERROR HANDLING
RD-LAP/ MDC STACK
RF
RF-MODEM
PROTOCOL CONVERSION
RD-LAP/ MDC STACK
NCL
RS-232
3201 APPLI-CATION
NETWORK ERROR HANDLING
NCL

FIG. 15

#4

ATTORNEY'S DOCKET NO. SIM0065

PCT/USA NATIONAL DECLARATION AND POWER OF ATTORNEY
FOR U.S. PATENT APPLICATIONS
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER 35 U.S.C. SECTION 371(c)(4)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name:

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the invention described and claimed in international application No. PCT/CA98/01146 entitled: INTELLIGENT COMMUNICATION SERVER AND COMMUNICATION SYSTEM INCORPORATING SAME, and as amended on _____ (if any), which I have reviewed, and I understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and for which I solicit a patent; that I do not know and do not believe that this invention was ever known or used in the United States of America before my or our invention or discovery thereof, or patented or described in any printed publication in any country before my or our invention or discovery thereof, or more than one year prior to my international application; that this invention was not in public use or on sale in the United States of America for more than one year prior to my international application; that this invention has not been patented or made the subject of an inventor's certificate issued before the date of my international application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months before my international application; that I acknowledge my duty to disclose information of which I am aware which is material to patentability of this application; and that prior to filing said international application, applications for patent or inventor's certificate on this invention of discovery which have been filed by me or my legal representatives or assigns in any country foreign to the United States of America are as follows:

(a) none filed more than 12 months prior to said international application, unless named below:

(b) earliest filed less than 12 months prior to said international application (the priority of which is hereby claimed under 35 U.S.C. Section 365):

Canadian Patent Application No. 2,225,227 filed 18 December 1997

I hereby claim the benefit under Title 35, United States Code, §120, of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)	(Filing Date)	(Status)(patented, pending, abandoned)

As a named inventor, I hereby appoint John F. Hoffman, Regis. No. 26,280; Anthony Niewyk, Regis. No. 26,871; Kevin R. Erdman, Regis. No. 33,687; Michael D. Smith, Regis. No. 40,181; Michael C. Bartol, Regis. No. 44,025; Arthur R. Whale, Regis. No. 18,778; Edward J. Prein, Regis. No. 37,212; James D. Hall, Regis. No. 24,893 and Ken C. Decker, Regis. No. 25,422; of BAKER & DANIELS, as attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

SEND CORRESPONDENCE TO:

JOHN F. HOFFMAN
BAKER & DANIELS
111 East Wayne Street, Suite 800
Fort Wayne, IN 46802

DIRECT TELEPHONE CALLS TO:

JOHN F. HOFFMAN
BAKER & DANIELS
111 East Wayne Street, Suite 800
Fort Wayne, IN 46802

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from John F. Hoffman as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from who instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

1-00

Full name of sole or first inventor: Michael Coveley

Residence Richmond Hill, Ontario, Canada CAX Citizenship United States of America

Post Office Address 6 Fairview Avenue, Richmond Hill, Ontario, L4C 6L2 CANADA

Inventor's Signature _____ Date Oct. 6, 1999

2-00

Full name of second joint inventor: Srdjan Milutinovic

Residence Brampton, Ontario, Canada CAX Citizenship Yugoslavia

Post Office Address 123 Bartley Bull Parkway, Brampton, Ontario L6W 2J8 CANADA

Inventor's Signature _____ Date Oct. 6, 1999